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The largest dredges of the United States Engineer Department are all driven by

McINTOSH & SEYMOUR DIESEL ENGINES

McINTOSH & SEYMOUR
CORPORATION
AUBURN, NEW YORK

JUNE, 1928

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Motorship

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Volume XIII | *June, 1928* | *Number 6*

Ship Conversions Helping America in World Trade

Impressions Gained from Inspection of M. S. City of Dalhart Are That We Must Convert More Ships to Diesel Power

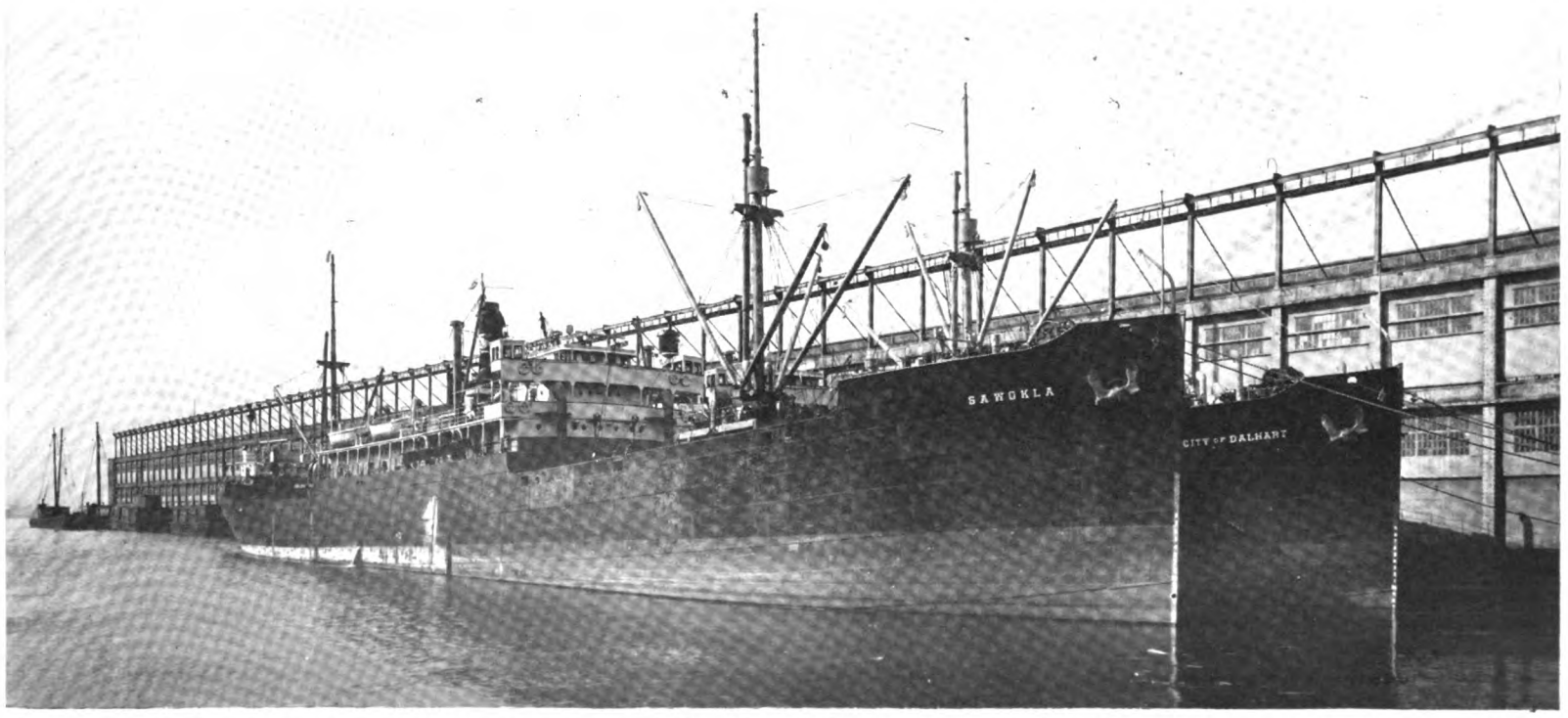
WATER will always level itself and so a fair yield of profit eventually must come to the American shipowner. This may be accomplished in many cases from the operation of motorships where it cannot be done with steamships. The reasons have been outlined so often as to rob the subject of all newness. Facts, figures, precedent have all been produced times without number. Yet we do not have a sufficient number of this economical type of ship!

It will be accomplished sometime, so why wait longer, when we already have waited over ten years too long. At the present time we have just enough motorships to whet the appetite of the ones who have found them to be the solution of many of their difficulties. Meanwhile foreign vessels carry most of our imports and exports. More of these splendid vessels must and will appear upon the scene under the American flag, provided an extensive continuation of the Shipping Board conversion program is carried out in addition to a sensible annual replacement program. If this is not done, good hulls will lie idle until they rust and rot; a condition which already has been allowed to go too far. If permitted to continue the American ship and marine engine building industry will fall into a decadent state beyond revival.

It is merely necessary to make a comparison between the Shipping Board vessels tied up in the Delaware, Hudson and James rivers with such vessels as have been converted to Diesel drive by the Board.

Two excellent examples of these conversions are the sister ships SAWOKLA—Capt. Thos. Sheridan—and CITY OF DALHART—Capt. Reginald Rose. Recently they were berthed side by side at Pier No. 4, Army Base, Brooklyn, after completing their latest voyages around the world in the Roosevelt Line's New York-Australia-Far East service, when we took the opportunity to inspect them.

Within shipping circles considerable attention has been attracted by the manner in which this American line invaded the Far East trade from India to the States.



Two of the twelve steamships converted to date by the U. S. Shipping Board. These vessels are all consistently demonstrating their economy and that the cost of the new power was well spent.

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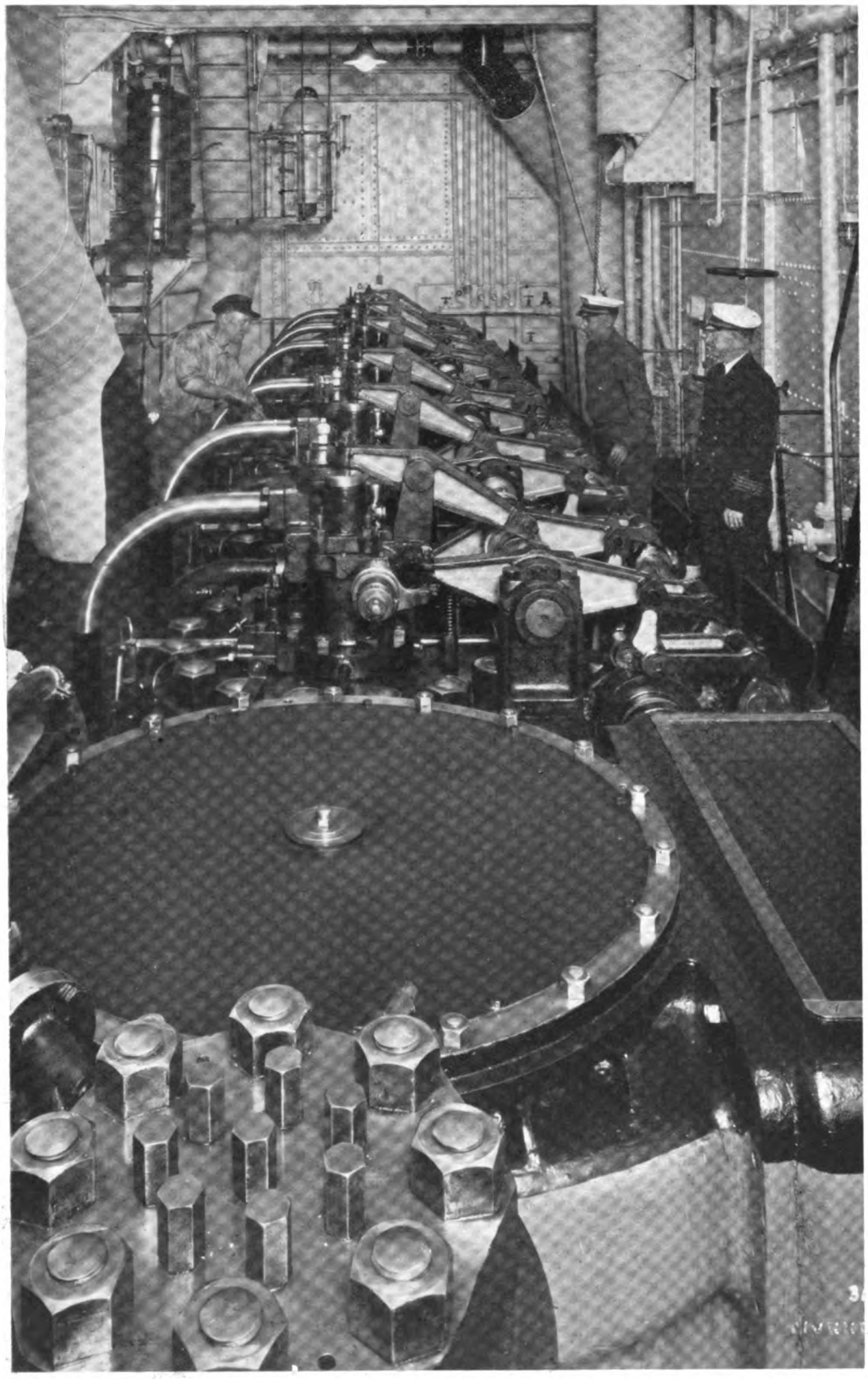
Had the vessels entering this competitive field been steamships, the fight could not have continued without involving an exceedingly heavy loss in a justifiable attempt to obtain a fair share of cargo bought and paid for by American business. Under the circumstances the competitive lines have been compelled to make peace overtures. If an amicable agreement has not actually been reached by the time these remarks appear in print, whereby the Roosevelt Line may obtain its fair share of the homeward bound cargo at an increased freight rate, then the time is not far distant.

In visiting the various motorships of the Shipping Board fleet one cannot help being impressed with the fact that all the converted vessels are in splendid condition. In fact, they are outstanding ships, and form a noteworthy group in the Board's fleet. They are the picture with a background of fog which must be cleared away in order to enlarge the subject and bring out more highlights such as we are about to mention.



This view of the Busch-Sulzer engine top of the City of Dalhart shows the compactness and cleanliness of the installation

The motorship, CITY OF DALHART, is one of the first group of twelve conversions made by the Shipping Board. The main propelling unit is a Busch-Sulzer 3000 shaft h.p., six-cylinder, two-cycle, single-acting, crosshead Diesel engine having a rated speed of 90 r.p.m. The work of conversion was carried out at the yard of the Newport News Shipbuilding & Drydock Co.

Arriving at New York on May 4th after traveling 25,572 sea miles, between pilot stations, her average speed was 12.09 knots, or nearly two knots better than her speed as a steamer. During the 105 days that she was away, a cargo from the United States was discharged in Australia, and another loaded there for India, where a portion of it was discharged and a final cargo was taken aboard for return to New York.

The CITY OF DALHART was not fully loaded when she sailed. She gathered up 1630 tons of general cargo in Atlantic ports. Of this she discharged 1523 tons in Australia and picked up 3048 tons of lumber, 128 tons of general cargo and 2561 tons of wheat. In India 5944 tons of lumber, general cargo and wheat were discharged. At Bombay and Karachi, India, 4309 tons and 1700 tons respectively, of general cargo were loaded. Thereafter no cargo was handled, save at Suez where she discharged 445 tons of flour. These figures reveal a total cargo transportation of no less than 13,376 tons, the major portion of which was picked up in foreign ports and transported to other foreign ports, indicating that American motorships can secure cargo at ports of call in face of the keen competition amongst ship operators throughout the world.

On the second voyage a slight improvement was made in speed, over the first one. Still better speed may be attained on subsequent trips in the event of improved weather conditions; but it would be difficult to crop a great deal off this established record through improved engine performance. After traveling some fifty odd thousand miles the engine has had the "wrinkles" smoothed out and is in fine running shape.

There are a number of definite reasons why a voyage of this length may be made by a motorship within a period of 105 days handling three cargoes. For one thing, a full fuel bunker was taken at Balboa, outward bound, where fuel is about the cheapest ($1.45 per bbl.) and it will not be necessary to refuel until the vessel reaches Balboa on the following voyage, outward bound. Also it was found possible to operate the main engine at full power continuously, giving a high average speed. High pressure, super-heated steam or pulverized coal under boilers cannot hope to equal such performance, by reason of fundamental conditions.

The Chief Engineer, George Brown, of the CITY OF DALHART, displayed a refreshing frankness in speaking of the machinery performance. There was no involuntary stop, although it was deemed advisable to shut down at sea on three separate occasions. This only involved a total loss of time of less than four hours. One stop was made to free and re-grind a sticking fuel-pump valve, another to repack a piston-cooling telescopic tube, and a third to change a leaking air-starting valve.

The Chief stated that he was not out to establish a non-stop around-the-world record, but rather to maintain his machinery in the finest mechanical condition and to prevent an involuntary stop if possible.

In support of his policy of taking a "stitch in time" he pointed out that no repairs, save routine work, had been made on

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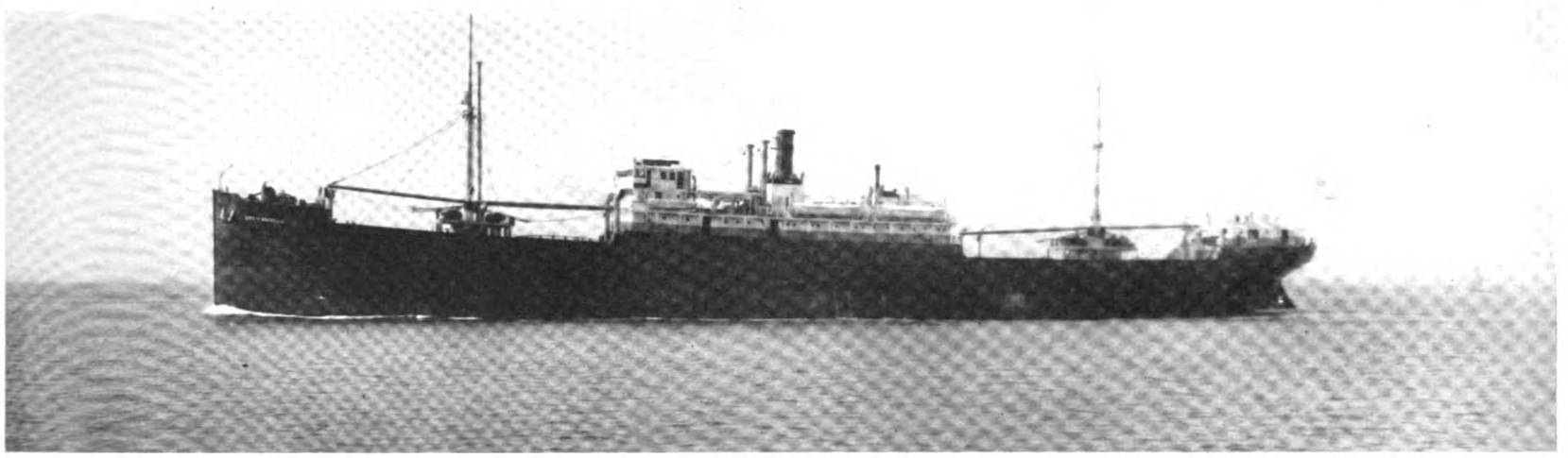


City of Rayville, one of four Shipping Board ex-steamers powered by Busch Sulzer Diesel engines. She now is a faster and far more efficient ship

the voyage. Furthermore, none were needed upon his return, the vessel being ready to sail on another trip around the world at a moment's notice. This, without touching any of the machinery on deck or in the engine-room, save, of course, to operate it.

We can only dwell briefly upon features of the voyage which could not be equalled by a steamship. Due to the characteristics of steam propulsion, the rate of fuel consumption is so high as to make it impossible to carry fuel and water enough—and a paying cargo—to travel 25,000 miles without rebunkering. So we venture to state that to equal the CITY OF DALHART'S performance would be difficult, and perhaps impossible, by a vessel propelled with steam.

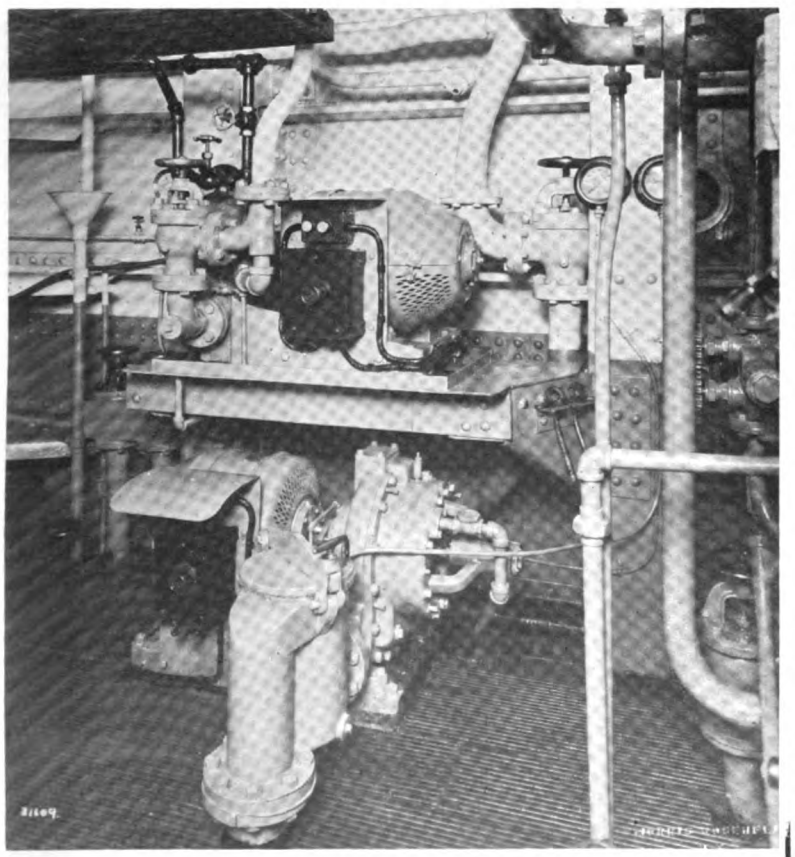
Re-fueling alone always causes delays, and sometimes it is necessary to make long detours in order to make special bunkering calls at ports where fuel is frequently expensive compared with prices at the Canal Zone. Thus the motorship has the added advantage of obtaining fuel at low prices. Long voyages without re-fueling are made by all motorships such as the CITY OF DALHART.

Reports of the ship's performance are given in the following table:

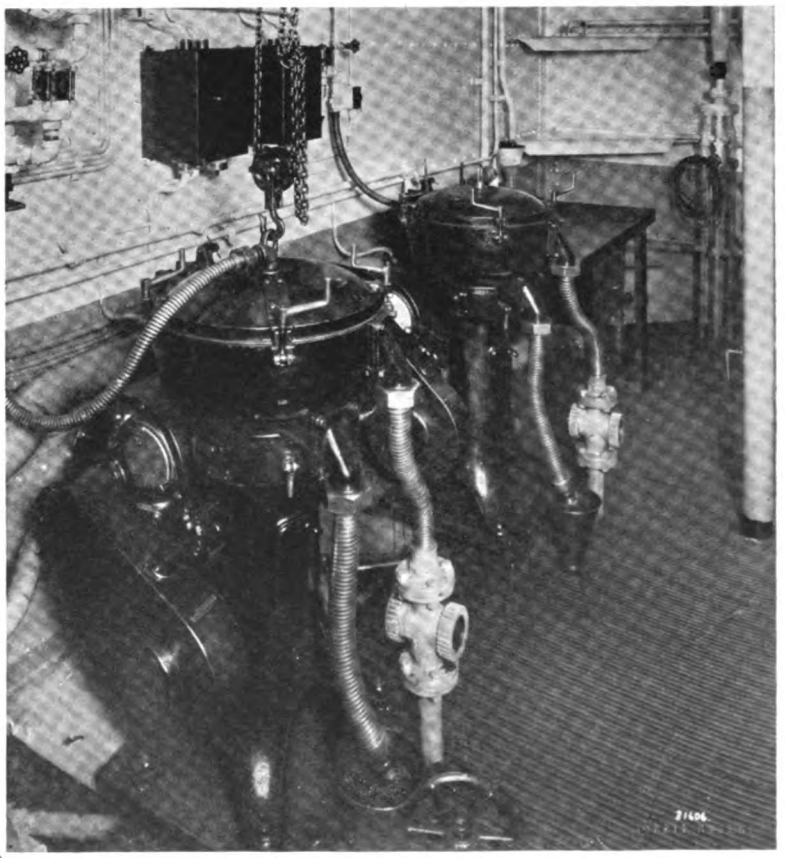
Total distance between pilot stations	25,572 sea miles
Average speed	12.09 knots
Average sea fuel consumption for all purposes	102.9 bbls. per day
Average port fuel consumption for all purposes	6.77 bbls. per day
Total fuel consumed between pilot stations	8981 bbls.
Total fuel consumed pilot station to dock	122 bbls.
Total fuel consumed dock to pilot station	110 bbls.
Total fuel consumed in port	356 bbls.
Total fuel consumed on 25,572-mile voyage	9569 bbls. or 1334.59 tons
Total cost or fuel used at sea and in port (105 days)	$13,875

These figures are important. Let us assume that the steamship ALGIC makes the same voyage. She is a vessel of about the same size as the CITY OF DALHART, a little smaller perhaps. The power plant is Westinghouse geared-turbine and B. & W. boilers. Fuel economy is excellent as steamships go but not comparable to motorships. On one long voyage she averaged 9.75 knots burning 171 bbls. of fuel per day. In port she consumed an average of 28.4 bbls. per day. Her fuel capacity is 13,260 bbls., which is a much bigger slice of deadweight capacity than the 1334 tons burned by the motorship in over 25,000 miles. Sailing from New York it would require about 32 days to reach Brisbane at a total consumption of 5472 bbls. She would spend about 18 days in Australian ports consuming 511 bbls. There would be approximately 9 days coastwise requiring 1539 bbls. From Australia to Colombo would require some 13 days consuming 2223 bbls. at sea.

At this point the total consumption would



***The upper** pump is for fresh water transfer and the lower is the **bilge pump.** Both are of the Nash self-priming centrifugal type*



The two De Laval fuel-oil centrifugal separators are gas tight. There also is a standard purifier of the same make for lubricating oil

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be 9745 bbls. and the owners would be confronted with the problem of shortly refueling at a point in the world where bunkers are very expensive. True enough she could reach Aden or Suez. To enter the Mediteranean with empty bunkers would be sheer folly since the Suez Canal forms a hurdle in the scheme of transportation, and at that point bunker prices leap.

It is generally believed that steamers enjoy a lower price per unit of fuel than do motorships. This is true only in the uncertain event of both vessels bunkering at the same fuel station; and when using different fuels. Therefore, it is glaringly apparent that a price differential favorable to the steamship does not always exist, and that the latter frequently burns low grade fuel costing more per ton than Diesel bunkers. Sometimes a motorship will burn boiler oil.

In operating on trade routes such as this there may be opportunities to take a full cargo, a portion of which would be shut out for want of net-cargo capacity on a steamer such as we have under discussion, since not only would she be heavily loaded with fuel but would carry full water tanks. Or, if not, the rate of fuel consumption would increase through use of the evaporators.

It is apparent that this is not purely a case of increased profits accruing from a better rate of fuel consumption. We have cited a steamer of about the same size which is said to have the same power, yet we find that the steamer does not equal the motorship in speed over a year's or long voyage average.

The explanation requires but little thought. No doubt the steamer can make the speed; but at what cost! It is an open secret that to "drive" a steamship makes of her a "fuel hog." To bring the speed up to that of a motorship with equal power will require a higher rate of fuel consumption, per day, per horsepower, per sea mile; in port it increases proportionally. In every way it stands at a higher figure.

To return to the engine-room of the CITY OF DALHART, Mr. Brown has formulated a number of excellent operating methods, which no doubt are somewhat responsible for the splendid performance of the machinery. One of these has been the continuous use of the centrifuges for both fuel and lubricating oils used in the main and auxiliary Diesels. The centrifuges on this ship, by the way, are De Laval.

Naturally, clean fuel and lubricating oils are not the sole requisites of successful engine performance; but without them even the best engines cannot be expected to give satisfactory service. With the engine of the CITY OF DALHART a minimum amount of wear has been found in such working parts as have been opened up during the routine precedure of overhaul in port. Of particular significance is the fact that, save for the one sticking fuel-pump valve mentioned, no difficulty has been encountered with the fuel pumping or injection devices on either the main or auxiliary engines. Had such difficulties been encountered in the auxiliary engines only, they could have been rectified at sea without delay as only one is in operation. But, such would not be the case with the main engine. The CITY OF DALHART is a single-screw vessel and any stop of the main propelling unit would cause a delay of the ship.

The Chief was of the opinion that it would be impossible to improve upon the existing installation, which speaks well for the engine-builder and for the Shipping Board's specifications and for the thorough manner in which conversions of this kind have been made by the shipyard.

On the CITY OF DALHART there is silent evidence of excellent performance in the form of a well-kept and orderly engine-room. Where there are machinery troubles at sea, the engine-room crew is unable to devote time to "dressing up" engines in the manner in which we found the machinery on this vessel.

Frequent repetition of this performance may be reasonably expected with the conversion of more ships, as the other ships of the converted "fleet" are also putting up splendid performances as already outlined in our pages. Some of them are making marine history. This will lead to greater expansion of our shipping and our trade between other countries. Dependability is a factor of no mean importance in the establishment of profitable trade, and the motorship is no longer looked upon as erratic in performance. It is purely a question of continuing to produce ships comparable to the CITY OF DALHART and other units of the converted fleet, which operate at a minimum cost and render a service obtainable in no other way.

While a maintained sea speed of 12 knots is not high when one compares it with the latest high-powered European cargo liners, it is very much better than is being averaged by many of the board's steamers now in service. (The latter, by the way, also must be converted as fast as they can temporarily withdrew and be replaced by converted ships.) Furthermore, there are many services where 15 to 16 knots is neither required nor economical, even with Diesel power, and it is for these services that more conversions must be carried out. For the higher speed and more competitive routes America must build new, fast, combination passenger-cargo motorliners, of advanced design. Congress has authorized the Shipping Board to plan and submit its requirements for such vessels.

National Oil and Gas Power Meeting

THE first national meeting of the Oil and Gas Power Division of the American Society of Mechanical Engineers will be held at the Pennsylvania State College at State College, Pa. Following is the tentative three-day program of addresses:

Thursday Morning, June 14
General Session 10:30 A. M., Schwab Auditorium

(1) Address of Welcome:
Dr. R. D. Hetzel, President, The Pennsylvania State College.

(2) European Diesel Engine Development:
Oliver F. Allen, International General Electric Company.

Thursday, June 14, 2:00 P. M.
Schwab Auditorium
Chairman: Dean R. L. Sackett
School of Engineering

(1) The Economic Field for Small and Medium Size Diesel Engines. H. A. Pratt, Manager Oil Engine Department, Ingersol Rand Company.

(2) The Economic Field for Large Diesel Engines. E. B. Pollister, General Manager, Busch-Sulzer Bros. Diesel Engine Company.

(3) The Diesel Engine and the Public Utilities. Roswell H. Ward, Managing Editor.

Friday, June 15, 9:00 A. M.
Schwab Auditorium
Chairman: Dean G. L. Wendt
School of Chemistry and Physics
Conference on Diesel Fuel Oil Specifications

(1) Statement of the Problem. G. H. Michler, Standard Oil Company, N. J.
Discussion by:
Representative of U. S. Navy
" " U. S. Shipping Board
" " Fairbanks, Morse Company
" " Chicago Pneumatic Tool Company
" " McIntosh and Seymour Corporation
" " A. S. T. M.
" " Petroleum Institute
" " Gulf Refining Company
and others

Friday, June 15, 2:00 P. M.
Cathaum Theatre
Chairman: G. W. Lewis, Director, Aeronautical Research, National Advisory Committee for Aeronautics

(1) Cooperative Oil Engine Research. Harte Cooke, McIntosh & Seymour Corporation, Chairman Survey Committee, Oil and Gas Power Division A. S. N. E.

(2) Penn State Oil Spray Research. P. H. Schweitzer, Associate Professor of Engineering Research.

Inspection of Penn State Oil Spray Apparatus in Operation.

Inspection of Engine and Accessory Exhibits.

Friday, June 15, 6:30 P. M.
McAllister Hall
Banquet—Informal
Dean R. L. Sackett, Toastmaster
8:15 P. M. Schwab Auditorium

Addresses:

Charles M. Schwab, Past President, A. S M. E., Trustee, The Pennsylvania State College.

Geo. Heath, Managing Director, Carels Diesel and Steam Engines, Ltd., London.

Saturday, June 16, 8:15 A. M.

Inspection of Penn State Fuel Oil Spray Apparatus in Operation.

Inspection of Engine and Accessory Exhibits.

10:15 A. M. Schwab Auditorium

Chairman: E. J. Kates, Chairman Oil and Gas, Power Division A. S. M. E.

Symposium—Specialization in Oil Engine Manufacture.

(1) C. R. Alden, Chief Engineer Ex-Cell-O Tool and Manufacturing Company.

(2) O. D. Treiber, President Treiber Diesel Engine Corporation.

Saturday, June 16, 3:00 P. M.

The editorial and business staff of MOTORSHIP and of *Oil Engine Power* will be present at this meeting.

Regarding the report that the Dollar Line will build five fast round-the-world Diesel liners, as we close for press R. Stanley Dollar wires us that the replacement program under consideration is not yet sufficiently crystallized to give particulars.

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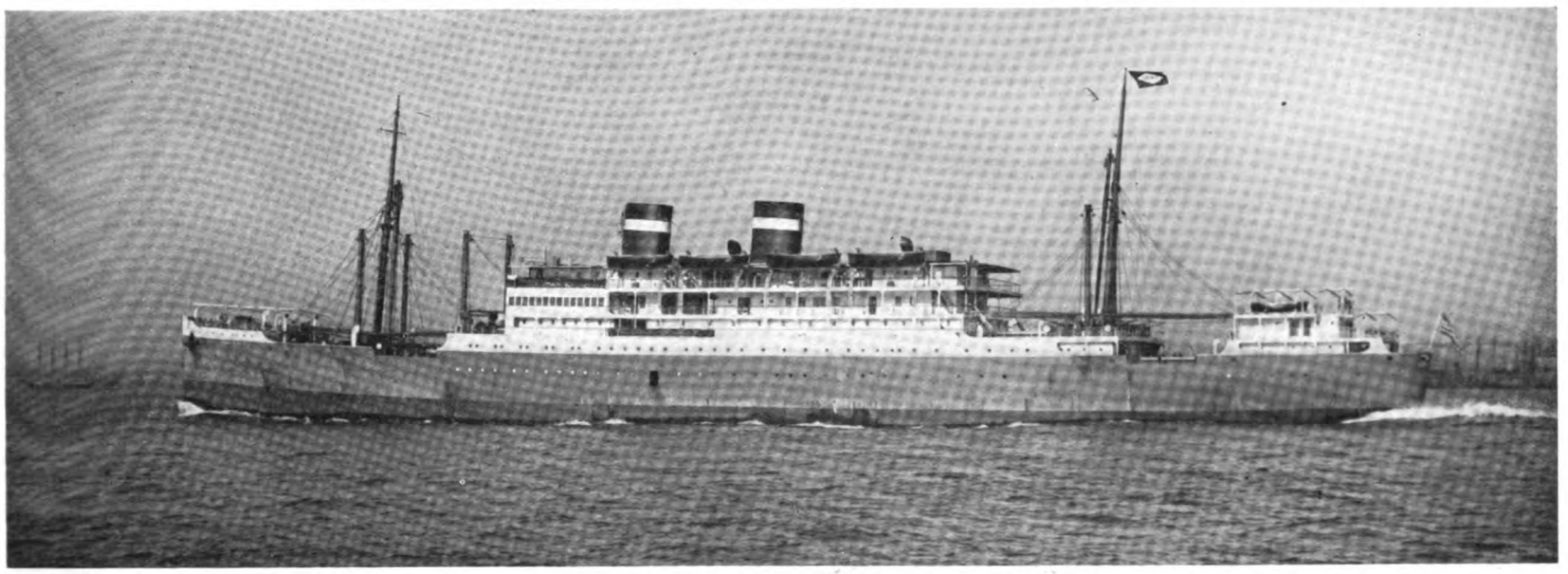

Santa Maria enters New York on her first voyage

Revolutionizing Sea Trade To South America

Two New, Swift, Diesel-Driven British-Built Passenger-Cargo Liners Replace Two Steamers in Fleet of Four Operated by American Ship-Owning Company

THE shipowner must know his cargo in order to provide suitable vessels upon which to transport it. Passengers are in a way cargo of a highly complex nature which compels the provision of comforts and conveniences not only equal, but in many respects superior to their customary land surroundings, since the enforced confinement of life at sea must be compensated for in a manner to meet the varied and fastidious tastes of different ones aboard. In order to provide the highest degree of comfort and speed, consistent with such service, the Grace Line of New York has profited by their experiences with two small motorliners and produced the SANTA MARIA—an example of a modern combination passenger-cargo express carrier. The appointments of this new Diesel-driven vessel conform to the demands of first-class passenger trade. She is a motorship of 15,000 tons loaded displacement with a speed of 16½ knots and is powered with two Sulzer two-cycle, single-acting Diesels, developing 4000 s.h.p. each at 100 r.p.m. They were built by Sulzer Bros. of Winterthur, Switzerland.

The SANTA MARIA, just built in England for W. R. Grace & Co., the well-known New York shipowners, has been registered under American flag. Following her arrival from the yard of the Furness Shipbuilding Company, Haverton-Hill-on-Tees, where she and her sister motorship, the *Santa Barbara,* have been constructed, the *Santa Maria* sailed on her maiden voyage from New York to South America at noon on May 10th. While she was in New York, thousands of people visited her, including 1,500 on the first day.

She will be followed in about four months by the SANTA BARBARA and will trade between the North and South temperate zone passing through the tropics, both outward and inward bound, enroute between New York and Valparaiso, Chile, replacing two steamers. She is truly the latest of a long series of developments in West Coast of South America trade, which dates back some seventy-five years, and was started with irregular voyages of sailing vessels, around the Horn, followed in turn with steamship service through the Straits of Magellan, greatly shortened and improved with the completion of the Panama Canal and now comparable to the finest Transatlantic service. Trade in 1927 amounted to $1,773,800,000 compared with but $207,000,000 in 1898.

Of the many interesting features of this latest contribution to a more complete understanding and friendly relationship between the two Americas, the most important to our readers is the engine-room. The machinery installation is so arranged as to provide ample space in which to carry out the regular run of maintenance and overhaul work without having made deep inroads into the passenger accommodations, a condition capable of accomplishment in this efficient manner, only with the installation of Diesel machinery.

Trade routes covered by the Grace lines

The entire engine-room made a very favorable impression upon us, excepting the gear-driven, plunger-type bilge pumps which were easily the noisiest machines in the ship. The pump that was running almost completely drowned any noise emanating from one of the auxiliary Diesels in operation, and one could not hear a sound from some high-speed centrifugal pumps working close by. In Shipping Board motor vessels all pumps are either self-priming centrifugals or of the rotary type, both making for silent engine-rooms. Also, compared with American ship practice the emergency generating set in the engine-room seemed somewhat out of date, as it is of the hot-bulb, blow-torch starting type.

In the engine-room is located, of course, the two main propelling engines, auxiliary compressor, auxiliary generator, Drysdale pumps, Worthington-Simpson pumps, Weir pumps, Sharples centrifugal oil purifiers, Brown Boveri scavenging-air blowers, main switchboard, control gear for auxiliary power, and four 270 kw., 220 volt generators, driven by Sulzer-Diesel engines. Equalizer connections are provided, a rotary-type equalizer switch being mounted on each generator, and until this switch is closed the generator cannot be connected to the busbars. A pilot lamp on each generator panel of the main switchboard indicates when the generator is in service.

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The generators supply current to the electric motors, about 115 in number, and also to three 110 volt motor-generator transformers for the lighting services. These transformers are located on a level practically in line with the main engine camshaft platforms. In addition to the main generators there is a 30-kw., 220-volt emergency generator driven by a Gardner hot-bulb oil engine which may be put into operation for supplying lighting load in port.

Located on the boat deck is a 15 kw., 110 volt emergency lighting set, this generator also being oil-engine driven. Access to the emergency control room can be obtained either from the boat deck or engine-room, and in the event of complete failure occurring in the engine-room, the radio service, searchlights, navigation, and other essential lights can be maintained.

At the forward end of the engine-room, or a slightly higher level than that of the transformer sets, is the main switchboard which is 47 ft. 6 in. long, contains panels for the main generators, auxiliary generator, transformers, and scavenging blower motors, also distribution panels for the services to the pumps, winches and windlass, steering motors, refrigerating machines, galley and pantry cooking, smoke room cooking and other services. On each main generator panel is a voltmeter socket for a four pin plug, and by means of a chain driven shunt field regulator, the voltage can be adjusted for paralleling the generator on the line. An ammeter on each panel indicates the load taken by each generator. A feature of the transformer panels is that the circuit breakers cannot be closed unless the notched starting rheostat is in the "all in" position, and as the no-volt coil can only be energized when the starter is in the off position, errors cannot occur in switching.

Docking the Santa Maria. Her fine lines forward are clearly depicted

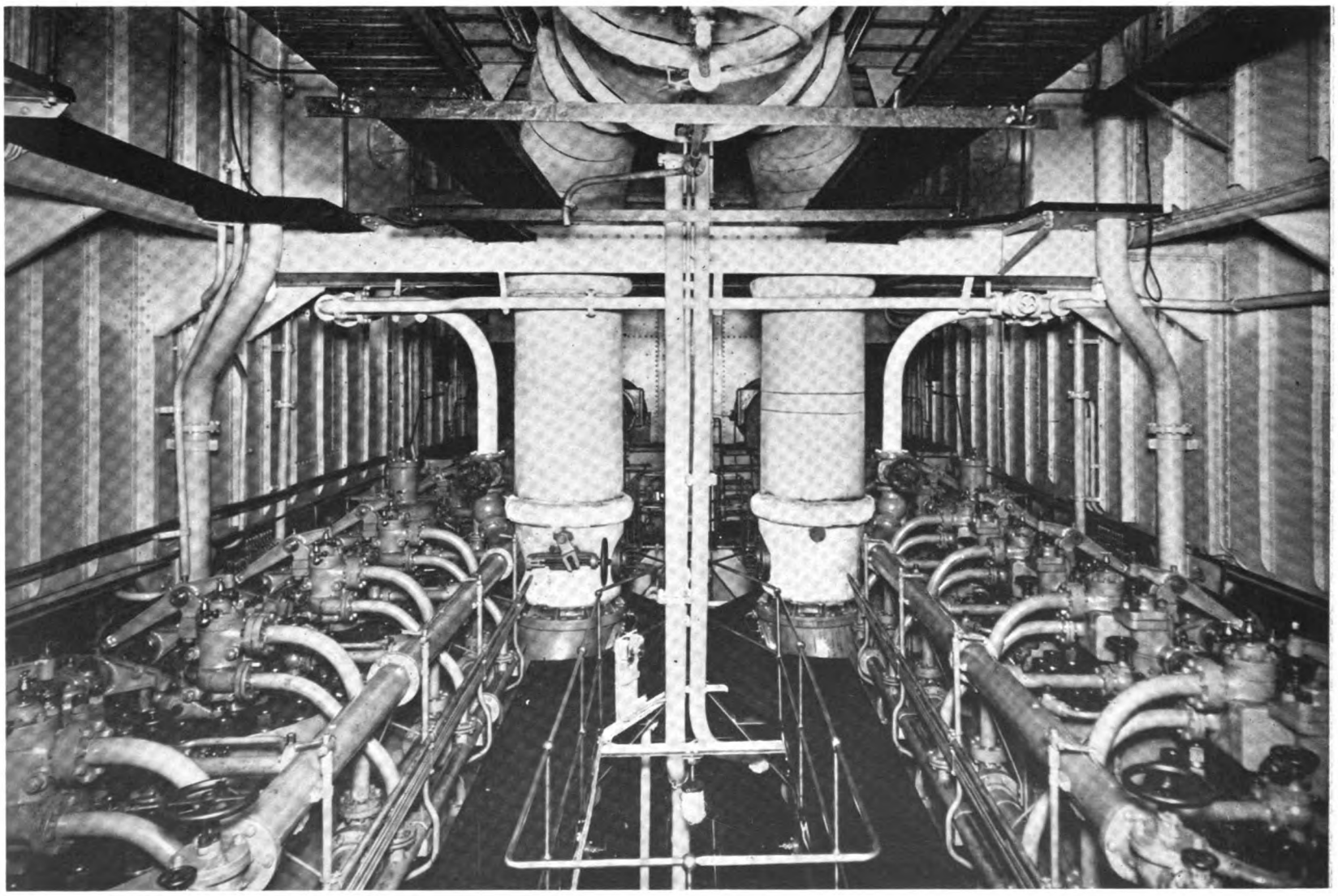
Pilot lamps on all the main and motor generator panels indicate which sets are in use.

The busbars are arranged so that the load taken by the chief units can be read on a recording ammeter, while a separate recording ammeter is installed for the section feeding the winches, steering gear, galley cooking and transformer sets. The feeders to both the forward and aft control room are in duplicate, and each section can be isolated in case of breakdown.

The 115 electric motors vary in size from ½ hp. and total 2600 hp. excluding the transformer motors.

Pilot house is Sperry equipped. There is a 2-unit Sperry Junior pilot which, in addition to automatic steering, forms the ship's main telemotor equipment. For standby steering there is a Sperry hydraulic telemotor. A mark eight Gyro-compass equipment is installed. Also, there is a Sperry steering, bearing and course recorder and repeater, enabling two bearings to be taken from the radio direction finder and from the Sperry rudder indicator. On either side of the bridge there is a Sperry 18 in. searchlight.

All deck machinery is electrically driven, including 19 winches and a windlass with motor mounted underneath. The motors have a main double pole isolating contact with overload relay in the forward contactor house controlled by two remote control switches, one fitted on deck at the control stand and the other in the windlass machinery room, under the deck. By this means it is possible to isolate completely



Simplicity of design of main engines is clearly shown in this view. Note exhaust pipes leading into silencer

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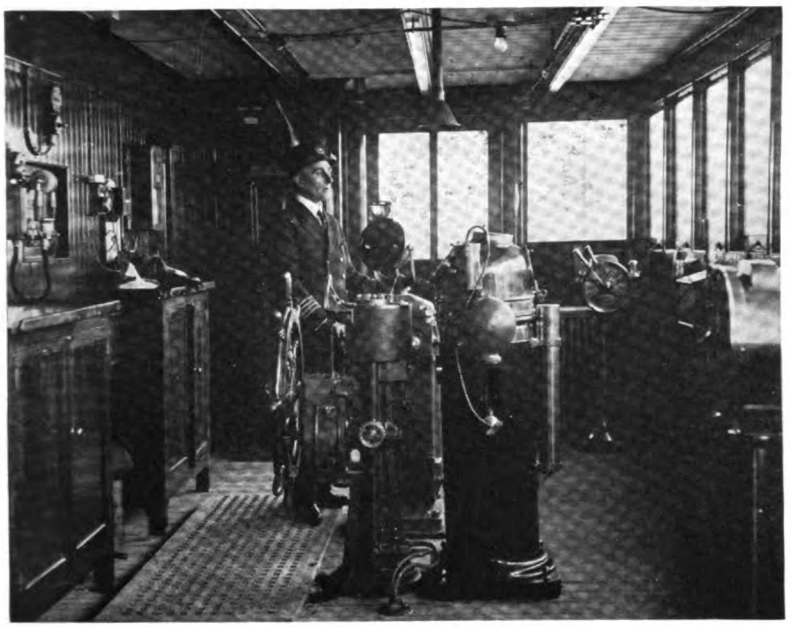
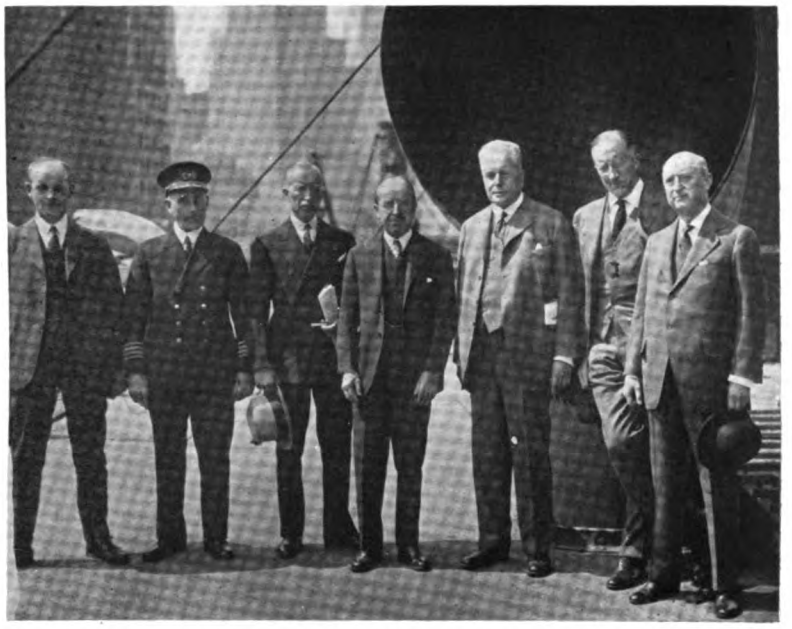


Pilot house of the Santa Maria has modern Sperry equipment, and the Metal Mike provides automatic steering. The Lux-Rich fire detector can be seen in the background. Standard steering equipment also is provided



The men who ordered the Santa Maria. Left to right: P. McIntosh, marine supt. Grace Line; Captain Parker; D. S. Inglchart, vice-president; Joseph P. Grace, president; L. H. Shearman, director; Gale H. Carter, president Grace Line, and M. Bouvier, director

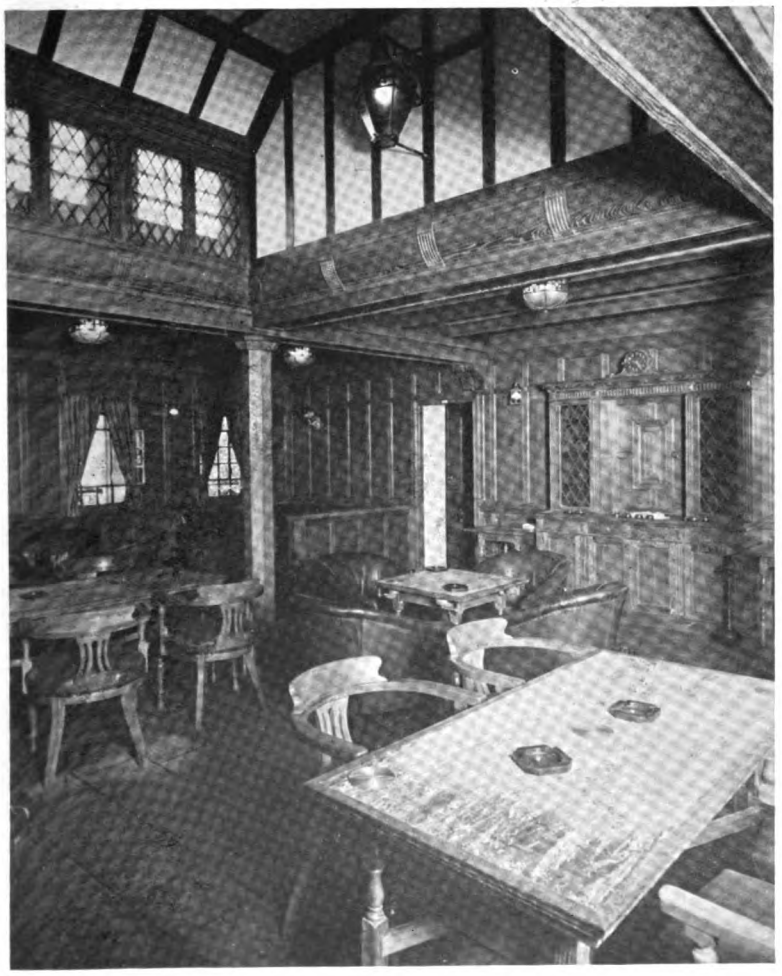
the windlass equipment on both poles, either at the control pillar on deck or in the machinery room. The windlass is fitted with an arrangement so that the motor can be stalled indefinitely with full load torque. Resetting contacts are fitted so that in the event of an overload or failure of supply, the windlass can be started up immediately by turning to the off position.

Life boats to suit the U. S. Steamboat Inspection Service Rules are provided, and MacLachlan davits are installed, together with electric boat hoists.

The passenger and other quarters are ventilated and heated or cooled by means of fresh air forced into the living spaces on the Thermotank "punkah louvre" system, which has ample capacity for maintaining a comfortable temperature for all conditions in hot and cold weather. So far this is the best ventilating system we have yet had personal experience with on sea voyages.

Each cabin is fitted with a thermal control unit mounted in the ceiling. In the event of fire this rings an alarm in the wheelhouse and automatically indicates the zone of the fire. Corys installed this plant and also the loudspeaking telephone equipment. The Lux-Rich system of Walter Kidde & Co., New York, is installed for indicating any trace of smoke in the holds and for extinguishing the flames.

Every comfort characteristic of the SANTA MARIA was designed to surpass similar features of other American flag ships. But results at sea depend upon the correct functioning of engine-room equipment; save, of course, the personal attention provided in deck and stewards departments. Supplying the maze of actual wire, pipe and duct arrangement must be a master source of perfectly dependable, power,



Our favorite place on a ship—a corner nook in the smoking room

Dining saloon of the Santa Maria is pleasing, but not too elaborate

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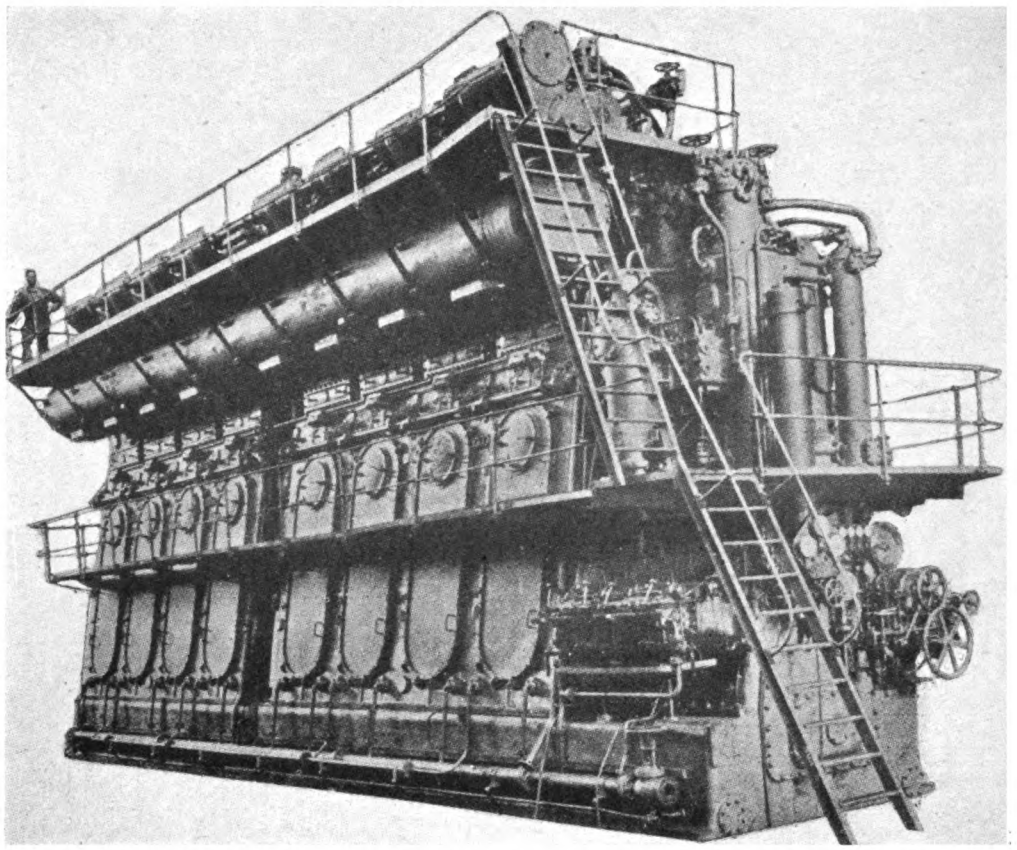
constantly at hand for discriminating passengers and available at the touches of electric buttons. This is less visible, but none the less an important detail that must be carried out with a high degree of skill in machinery construction and engine-room arrangement.

Over each main Diesel engine is suspended an electric monorail crane capable of lifting four tons, while over the auxiliary Diesels, which are located in the wings, are tracks and lifting gear comparable to similar equipment over the main engines of smaller vessels. A small machine shop with power-driven lathe, drill press and grinding wheel, is located on the machinery flat in the aft port corner of the engine room. This shop is small; but, no doubt, ample in size, since relatively few undertakings of a major nature are expected to occur at sea.

The ship has been amply provided with spare equipment as demanded by Lloyds and by the American Bureau of Shipping, all of which has been properly stowed away; the heavy parts, such as pistons, cylinder liners and two propeller shafts being securely bracketed in place, the latter in the shaft alley, the former at the forward end of the engine room, convenient to the cranes. Armatures have been covered with canvas and bolted fast to brackets near the motors in which they may be used, while the large wrenches have been placed in racks near at hand.

On the port side, forward of the switchboard, is a small room for engineers' stores, while in the after starboard side is a second storeroom used for engine spare parts which are kept under lock and key, pending the time they may be needed.



Double action has not been resorted to for this 4000 *s.hp. Sulzer Diesel engine of the Santa Maria. Twin engines are installed.*

The engine-room grating and piping arrangement is neat and convenient, special care having been exercised to prevent any of it from interfering with the removal of engine parts. In front of the engine doors the lower gratings are provided with hinges and fold back out of the way. The main engine exhaust pipes are joined in a single silencer suspended high in the engine-room with a single outlet to the stack. Valves are located in each exhaust pipe between the silencer and engines. This makes it

Fuel for electric cooking on the Santa Maria costs less than ½ cent per kw. hour. Electric cooking is just as economical on American-built motorships.

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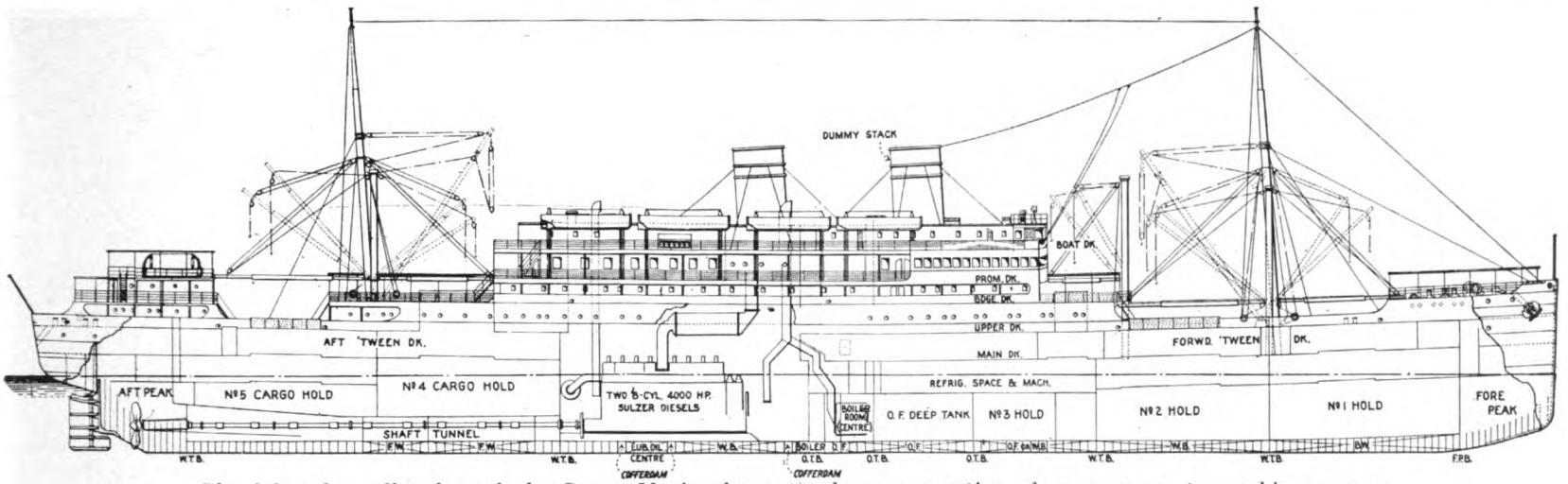


The inboard profile plan of the Santa Maria shows the large proportion of cargo room to machinery space

possible to work on one while the other engine is in operation, without the exhaust gases backing down from the running engine into the engine-room.

Arranged on the engine-room bulkhead forward, stands a bank of 15 high-pressure air bottles for fuel injection, while in the port wing are four large maneuvering air tanks. On each main engine are two compressors each with sufficient capacity to provide surplus air in the event of one compressor becoming out of order. Any number of the 15 high-pressure bottles may be held in reserve or they may all be cut in at one time and used as a cushion-bank against which one or all of the compressors, including those on the auxiliary engines, may work. A master distributing valve-block is located just forward of, and between, the engines, convenient to the engineer on the maneuvering flat. Hence the engine room telegraphs, main engine controls, air distribution central control, pressure gages, tachometers and every essential to maneuvering is within a radius of about five feet of the engineers' desk. There are also installed two oil fired boilers for steam heating when in cold weather.

In several previous issues MOTORSHIP has given general particulars of the SANTA MARIA, but a repetition of some of the dimensions will not be out of place at this time.

Displacement	15,000 tons
Length	485 ft.
Beam	64 ft.
Power	10,000 i.hp.
Speed	16½ kts.
Cargo capacity	7,000 tons
Passenger capacity	159, 1st class

The vessel has a cruiser stern, straight stem, and is of the two-deck type with complete shelter deck with tonnage opening aft. Above the shelter deck are the bridge and forecastle decks which, in turn, are surrounded by promenade boat and sun decks.

The hull is subdivided by nine complete watertight bulkheads, and a deep tank with three compartments is fitted forward of the machinery space in addition to the sides of the auxiliary boiler room and four cellular double bottom tanks for the carriage of oil fuel. Special fresh water tanks are arranged in the double bottom, and at the sides and between the shaft tunnels in accordance with the latest U. S. requirements.

The American idea of making the ship a homelike, congenial floating residence was carried out in every detail, and as a result there are numerous suites de luxe and a proportion of cabins with private baths, formerly undreamed of. There are no inside staterooms, and beds instead of berths are the rule. Only first-class passengers are carried, the maximum capacity being one hundred and fifty-seven.

A capacious swimming tank, a space for golf practice, wide decks for dancing, sports or the deck-chair siestas invited by the tropics are interesting features of the ship arrangement.

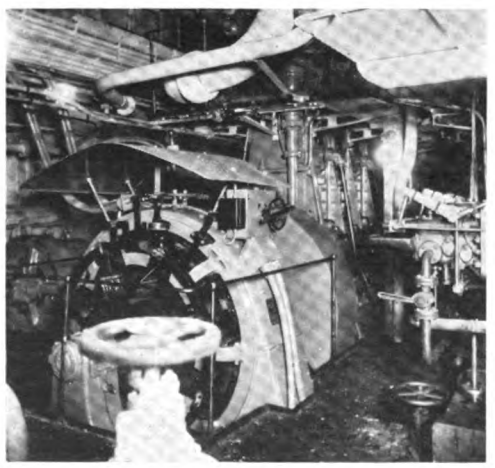
The promenade deck, upon which are situated the social hall, lounge, smoke room and verandah café, provides promenade facilities under all weather conditions, and a glass screen with sliding windows is fitted at the forward end and for a considerable distance along each side.

Eight insulated chambers are provided for the ship's provisions, and six special insulated cargo chambers are arranged for carriage of fruit, together with all the necessary fans, coolers, brine grids, meat hooks, and three electrically-driven co-refrigerating machines.

The culinary and laundry departments are all electrically operated with all the most modern equipment, including electric cooking ranges, etc., both for passengers and crew.

Purser's bureau, barber shop, printing rooms and children's dining rooms are also special features. Ample baggage, mail, bullion and store rooms are provided.

Twenty-six ocean-going steamers and motorships, totaling 170,769 deadweight tons, operated in seven distinct passenger and freight services linking North, Central and South America: such is a brief description of the activities of the American shipowner firm of W. R. Grace & Co.



One of four 270 kw. Sulzer Diesel auxiliary generator sets.

These include not only the Grace Line operating under the Grace House Flag, but also the Panama Mail Steamship Company and the New Orleans and South American Steamship Company (Nosa Line), which are owned by W. R. Grace & Co. The present fleet consists in part of vessels purchased from the United States Shipping Board and operated under a guarantee of permanent service in accordance with the provisions of the Merchant Marine Act.

The greater speed of the SANTA MARIA and the SANTA BARBARA will permit them to call, on both the outward and homeward voyages, at Havana, affording a pleasant break in the journey.

Fruit-Carriers Ordered

The Standard Fruit and Steamship Corporation of New Orleans, Felix P. Vaccaro, President, has now placed orders for four of the vessels for which tenders had been invited from British and Continental builders. Two of these, to be steam-driven, are to be built by Swan, Hunter & Wigham, Richardson, Newcastle-on-Tyne, and two which are to be Diesel-driven are to be built by the Cosulich Co. (Cantiere Navale Triestino). These vessels are to be between 400 ft. and 430 ft. long, and are to be employed in the fruit-carrying and passenger service between the United States and Italy. Eight British firms in all competed for the work. Swan, Hunter have already built a number of vessels for the Standard Company and its allied concerns, the Mexican American Fruit and Steamship Corporation and Bragmans Bluff Lumber Incorporated.

Passengers on Cargo Motorship

A new demand seems to be arising for accommodations for passage on freighters. Recently the Roosevelt Lines announced that three of their vessels had sailed during the past month with a full complement of passengers. One of them was from New York to Australia, another from India to New York via the Suez Canal and the other from Australia to New York via the Panama Canal. The new motorships operated by the Roosevelt Lines have passenger accommodations for twelve on each ship, and fares range from $300 to $350 to India, $500 to $525 to Port Said, $650 to Gibraltar and $800 for the round the world trip.

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The Editorial Viewpoint

Reconditioning the Mount Vernon and Monticello

PRESIDENT COOLIDGE has signed the Bill which empowers the United States Shipping Board to spend $12,000,000 reconditioning the ex-German passenger liners MOUNT VERNON and MONTICELLO. Plans drawn up for the Board call for the installation of American-built Diesel engines in these find old rustless hulls. The cost will only be a little higher than that of installing steam machinery, while the economies effected will offset the additional cost many times over. One well-known domestic shipyard is preparing alternative plans on its own responsibility and will submit the same to the Board. These plans call for the installation of either geared-turbine or turbo-electric drive.

A point has been raised as to whether the Shipping Board can legally install anything but internal-combustion engines in instances where new machinery must be fitted in ships which it remodels and reconditions. The 1928 Merchant Marine Act just passed by Congress upholds Section 12 of the Act of 1920 as amended in 1924, which reads as follows:

"The term 'reconditioned' as used in this section includes the substitution of the most modern, the most efficient and the most economical types of *internal-combustion engines* as the main propulsive power of vessels."

The word "includes" may possibly be like President Coolidge's "choose" and mean anything anyone cares to interpret; but, the intention of Congress at that time would seem to be clear, and definitely states *internal-combustion engines* for reconditioned ships. Therefore, it is possible that if any form of power other than Diesel engines were installed in the MOUNT VERNON and MONTICELLO, the Shipping Board would be violating the spirit of the Act—if not the legal interpretation. This, of course, is a point which no doubt the legal advisors of the Board will study and pass upon.

America First!

ELSEWHERE IN THIS ISSUE is given a description of the first of two fine motorliners built for American shipowners for the North-South American trade. Modern in every respect, and more economical in operation than any other large American-owned passenger ships, one cannot but admire the progressive spirit of the owners. Because of the advanced character of this noteworthy ship and her machinery, we give her the fullest publicity. But, there is no denying that our editorial pen would have written far more enthusiastically had our shipyards and engine builders materially benefited by her construction, instead of the orders having gone abroad. There is a possible bright spot on the horizon, namely, that it is to be hoped her owners will replace the two remaining steamers on this run with two American-built motorships. Then the American marine industry will benefit, and the experience gained in the construction and operation of the SANTA MARIA and SANTA BARBARA will be of the greatest value.

Government Operation on the Inland Waterways

ON THE EDITORIAL desk is a copy of the annual report of the Inland Waterways Corporation to the Secretary of War for the calendar year of 1927. As is general knowledge, the Inland Waterways Corporation was formed for the purpose of developing trade and navigation on our great rivers, with Major General P. Q. Ashburn as Chairman and Executive. The report is dated March 14th of this year and consists of 66 pages. Although many private interests operating on our rivers have turned to Diesel and Diesel-electric drive during the last few years, a close study of this official report fails to reveal any investigation having been made by the Inland Waterways Corporation into the use of Diesel power, nor is there any record of any Diesel-driven tugs or other such craft having been built by the Corporation. Considerable space, however, has been devoted to the endeavors of the Corporation to develop the use of pulverized coal for river craft. Explanation is given of the difficulty and troubles encountered. Apparently General Ashburn met with similar comments that motor vessel and Diesel-engine builders had to contend with in the early days of the industry, for he makes the following statement:—

"It really seemed as if the gloomy predications and 'I told you so's' of the opponents of any progressive idea had cast a 'hoodoo' over the boat. Every conceivable thing that could happen to the boat not directly connected with the experiment did happen, and our critics seized upon it as an evidence that powdered coal was a failure and that 'good Government money for which we were taxed' was being thrown away wastefully and criminally."

It is to be hoped the Inland Waterways will lose no time in making an exhaustive study of the operation of the many Diesel-driven boats now operated under private ownership on the rivers, and adopting this form of economical power for any new vessels built for the Corporation.

King Canute Also Tried to Stem the Tide!

IT APPEARS THAT the United States is not the only country where "eminent authorities" on marine engineering and maritime economics continuously claim that steam in its latest form is in every way superior to Diesel power for ship propulsion mainly because of its lower first cost. In England Sir John Biles, the well-known consulting engineer, annually puts forward his plea for shipowners to stick to steam, and demonstrates by means of estimates that the cost of operating steamers are far less than those of motorships. With due apologies to Sir John, British shipowners continue to increase their Diesel tonnage regardless of the fact that home-produced coal is cheap and oil has to be imported or bunkered abroad.

Canal Tolls—What Does Your Ship Pay Per Ton of Net Cargo?

THESE EDITORIAL PAGES have always made an issue of the importance of designing a motorship exclusively as a motorship. The plan prevalent among our shipowners is to design a steamship and then to ask shipbuilders for bids for the same hull with Diesel power as well as for steam drive. When our shipowners wake up to the fallacy of this policy, and fully appreciate that a motorship is an entirely different vessel from a steamer, then will our oil-engine plants be much busier, and the marine boiler works less active.

Recently the Swedish motorship AMERIKALAND (chartered for 20 years to a subsidiary of the Bethlehem Steel Co.) established a new record for low cost of tolls paid per ton of net-cargo at the Panama Canal. Specially designed as a motorship, and with low tonnage dues in mind, she was enabled to carry 21,600 tons of actual cargo with only $4,678.75 in tolls, or $0.2166 per ton. The previous record of $0.2176 was also made by this big Diesel-driven carrier. Design a vessel as a motorship and the maximum all-round efficiency will be secured.

Cone Replaces Benson on Shipping Board

APPARENTLY REAR ADMIRAL WILLIAM S. BENSON, Commissioner of the Shipping Board has displeased President Coolidge, because of his consistently voting against the sale of government ships to private owners. President Coolidge has appointed Rear Admiral Hutch I. Cone of Florida as Commissioner of the Shipping Board in place of Rear Admiral William S. Benson, whose term expires June 1st.

Many people associated with the motorvessel and Diesel engine industry will regret the departure of Admiral Benson from the Board, as he has been a consistent fighter for the Diesel engine. Many years ago he foresaw the advantages which were bound to accrue from the use of Diesel power in the government as well as privately owned ships. All the conversions carried out to date by the Shipping Board have been under direct control of Admiral Benson. It is to be hoped that Admiral Cone is equally convinced of the economy of Diesel power and great importance of further conversions and new motorship construction to the shipping of the country.

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Congress Passes Merchant Marine Bill

The 1928 Act, While Not Ideal, Is Constructive and Should Be a Big Aid in Developing Our Merchant Marine From the Lethargy Into Which It Has Fallen

(*Full text on page* 513)

AT last Congress has passed legislation calculated to produce considerable activity in American shipyards and engine building plants within a short period. The new Act, while far from being ideal, contains sufficient measures and indirect subsidies to ensure private interests building a considerable number of new vessels in the near future. There still hangs over the head of private shipping the huge fleet of steamships owned, operated and laid-up by the Shipping Board. But the new Act enables shipowners to purchase these vessels from the Board, borrow money at a low rate of interest, and convert them to Diesel power. For this purpose and to aid in new ship construction, the Loan Fund has been increased to $250,000,000. The Second Deficiency Bill, since passed by the Senate, appropriates $7,500,000 for mail contracts for American ships.

Section 202 of the new act upholds Section 12 of the Ship Conversion Act (U.S.C., Title 46, Sec. 871) of 1924 and gives the Shipping Board power to remodel and improve vessels *in addition to the reconditioning powers of the amended Section* 12 *of* 1928. It will be recalled that this amendment instructs the Shipping Board to instal *internal-combustion engines* when reconditioning ships. We reproduce the amended section 12 herewith.

"The term 'reconditioned' as used in this section includes the substitution of the most modern, most efficient, and most economical types of *internal-combustion* engines as the main propulsive power of vessels. Should the Board have any such engines built in the United States and installed, in private shipyards or navy yards of the United States, in one or more merchant vessels owned by the United States, and the cost to the Board of such installation exceeds the amount of funds otherwise available to it for that use, the board may transfer to its funds from which expenditures under this section may be paid, from its construction loan fund authorized by section 11 of the Merchant Marine Act, 1920, so much as in its judgment may be necessary to meet obligations under contracts for such installation; and the Treasurer of the United States shall, at the request of the board, make the transfer accordingly: Provided, That the total amount hereafter expended by the Board for this purpose shall not in the aggregate exceed $25,000,000."

Therefore it is probably a legal point as to whether or not the Board can install anything but internal-combustion engines in any ship when reconditioned by the Board under the terms of the new Act of 1928, whenever reconditioning includes new propulsive machinery.

Congress has recognized that until the Shipping Board's ships are taken out of government ownership it is necessary to maintain the fleet in adequate condition, and to modernize it from time to time by replacements and conversions. Unfortunately, no actual sum of money has been authorized and appropriated for this purpose, the Board only being empowered to make its recommendations regarding new construction and conversions and place them before Congress for approval. A clause on another bill recently passed, empowers the Shipping Board to spend $12,000,000 *for the reconditioning* of the MOUNT VERNON and MONTICELLO, and plans prepared by Gibbs Bros. for the Shipping Board call for Diesel drive; but alternative plans for geared turbine and turbo-electric drives are being gotten up by the Newport News Shipbuilding Company, which they propose to offer to the Shipping Board.

Senator Wesley L. Jones, and Representative Wallace H. White were the sponsors of the 1928 Act. Senator Jones frankly told his fellow Senators, when the bill came up for the final vote, that the mail subvention is a subsidy. And, that he estimated about $7,500,000 would be paid annually to American shipping companies in connection with contracts for carrying the mails.

After the bill had passed the Senate and had been passed by the House with modifications, it went to the Conference Committee of the joint legislative bodies. Then it was returned to the House and approved, and referred to the Senate. For a while it looked as if the bill would be blocked by the republican insurgents in the Senate. In fact, Senator Brookhart served notice that he was prepared to filibuster indefinitely to prevent a vote being taken. Opposition suddenly stopped when Senator McNary admonished opponents that in doing so they actually were holding up the McNary-Haugen farm bill.

The Senate's final vote on the Shipping bill was:—

FOR THE CONFERENCE REPORT—51.

Republicans—28

Capper	Johnson	Sackettt
Couzens	Jones	Schall
Curtis	McLean	Shortridge
Cutting	McNary	Steiwer
Deneen	Metcalf	Vandenberg
Edge	Moses	Warren
Gillett	Oddie	Waterman
Goff	Phipps	Watson
Greene	Pine	
Hale	Reed (Pa.)	

Democrats—23

Barkley	Fletcher	Simmons
Bratton	Glass	Steck
Broussard	Hawes	Stephens
Bruce	Kendrick	Swanson
Caraway	Locher	Tyson
Copeland	Neely	Wagner
Dill	Pittman	Walsh (Mass.)
Edwards	Robinson (Ark.)	

AGAINST THE CONFERENCE REPORT—20

Republicans—9

Blaine	Howell	Norbeck
Borah	La Follette	Nye
Brookhart	McMaster	Smoot

Democrats—11

Black	King	Thomas
George	Mayfield	Tydings
Harris	Reed (O.)	Walsh (Mont.)
Heflin	Sheppard	

Then the measure was sent to President Coolidge and was signed. The text of the act as passed by the Senate is reproduced on page 513 of this issue of MOTORSHIP.

Replace the Old Thomas with Motor Transport

U. S. War Department Needs Modern Diesel-Driven Vessel for Carrying Officers, Men and Officers' Wives to Philippines

FOR about thirty years the transport THOMAS has been plugging away in the services of the American Army. Built for the Spanish-American War this old timer has done more than full-sized duty, and should be pensioned off to the target practicing ground for forts and aeroplanes, having gotten to the stage where she no longer is safe for the carrying of army officers, their wives, army men and automobiles. With due respect to General Sommerville, Chief-of-Staff of the War Department, it is somewhat surprising that she has not been replaced several years ago with a modern motorship capable of handling the transportation work with safety and economy. If there is no Congressional ruling or White House decision in the way we would like to see the General Staff wake up, get into action, and construct a new ship without further delay.

There has been some opposition to a new vessel by private owners, and by the Navy, both of which consider they should do the work under contract. We fail to see why the Navy should have the task, as it cannot do the work so cheaply and its real duty consists of seeing that the transports are safely convoyed during time of war. There is much more to be said for private ownership, but an obstacle in the way is that the book-cost to the army would be higher because the War Department is not allowed by law to take either overhead, or charges on capital, into its

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operating costs. Furthermore, the Army certainly should have several first-class, modern ships available for immediate use in any waters when needed. But such ships should be built in private shipyards, and not in the Navy Yards, which already have taken too much badly needed work away from domestic shipbuilders, such as two of the Shipping Board conversions.

Then again, ships operating out of the Pacific Coast ports to the Philippines are, we understand, mainly coal burners and owing to the high price of coal at Pacific Coast ports they are compelled to bunker sometimes at Moji and sometimes at Chingwantao, steaming off their course to do so.

The THOMAS is of 7,500 tons gross, and carries 1,000 men, 250 officers, their families, household goods and automobiles to and from the United States and Philippines. She can only make 12½ knots at her best—a fine (sic) speed for a passenger vessel in service today! To accomplish this she burns about 76 tons of coal per day. Judging by the fuel consumption, her engines and boilers no longer produce anything like their rated power. In fact only about 4,000 hp. now is indicated, so the fuel consumption works out at 1.75 lb. per i.hp. hour as compared with 0.3 lb. of oil for Diesel power.

To replace her with a fine, modern, Diesel-driven transport of similar size and capacity, but of much greater speed, would cost from $3,000,000 to $4,000,000, according to power and equipment—if built in private shipyards. Her design would meet the different conditions of today, and the hull would be fitted with side hatches, facilitating the embarking and disembarking of troops and the shipping of autos.

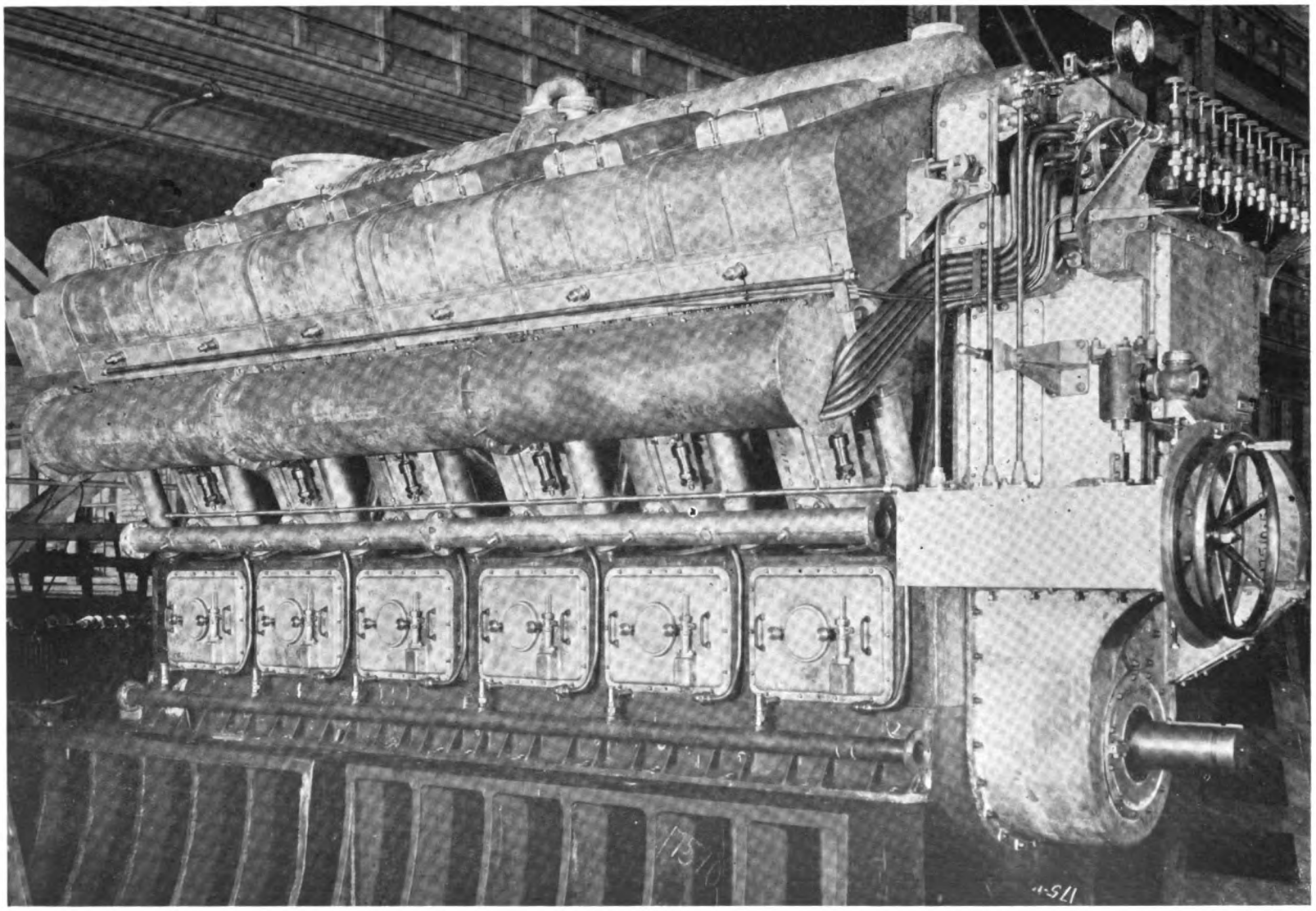
At the present time the Army's sea-going fleet consists of eight or nine transports of about the size of the THOMAS, some cable ships, and several freighters of 10,000 tons. As the War Department operates four large McIntosh & Seymour Diesel-electric sea-going dredges and a number of big steam dredges, it must be fully conversant with the economies.

A Big Diesel Engineering Development Step

First Details of the New Treiber 3000 s.hp. Marine Engine Which Weighs Under 32 Tons

THERE is a wonderful future for the powerful, high-speed, lightweight Diesel engine as soon as it is commercialized and as reliable as slower speed engines of equal power. By powerful we mean engines of 2000 hp. and over, as high-speed and light weight up to 1500 hp. already are a commercial proposition although none have gone below 75 lbs. per hp. except in small experimental units. Its possibilities for marine work, locomotives and airships are as yet untouched.

One of the biggest steps ever made in this direction has been under way for the past two years at the Camden plant of the Treiber Diesel Engineering Corp., under the direction of Otis D. Treiber, and a series of valuable tests have been run on the first of two high-powered engines. The test results indicate that the development accomplished is of no mean importance. In fact it has resulted in engineering knowledge of very considerable value to the Diesel industry at large.



The new Treiber V-type high-speed marine Diesel engine develops 3,000 *s.h.p. at* 700 *r.p.m. on a weight of* 21 *lbs. per horsepower*

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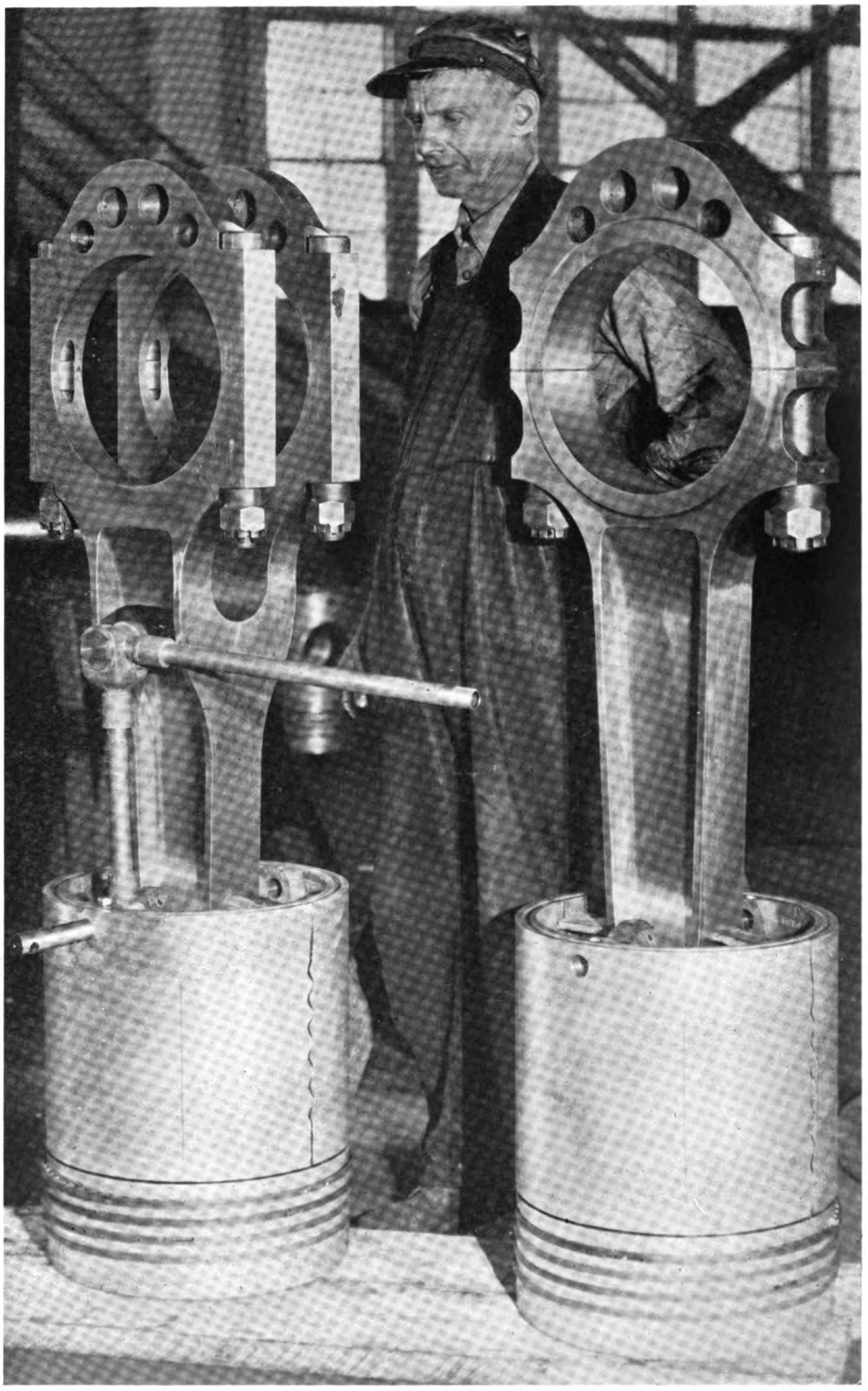
The Treiber engine is a directly reversible V-type unit of 3000 rated s.hp. in twelve 16″ x 16″ cylinders and with a designed speed of 700 r.p.m. and some features of its design will be discussed later in this article. Its weight is 63,200 lbs. and this record engine will be installed in a 40-knot express vessel to be built shortly.

Naturally many obstacles confronted the designers in building an engine of a power never before attempted on so light a weight and at such high speed. Advantage was taken of the progress made in carbureting engines used in automobiles and airplanes and using the new metal alloys now available, such as Bu-nite pistons. It is natural, therefore, that progress should be expected in reducing the weight of former large engines, insofar as the market will absorb the product and provide opportunities for further advance. As we will presently discuss, the Treiber Diesel engine has no cast iron in its construction, forged steel and aluminum alloy being used.

It has been pointed out that Diesel engines work with higher gas-pressures than do carbureting engines, having terrifically high preignition pressures which must be taken care of by additional strength or by unloading-valves. These make a Diesel engine of a given bore and stroke inherently heavier than a carbureting engine of the same bore and stroke.

The mean effective gas-pressures obtainable in a Diesel engine using natural aspiration are inherently lower than those of a carbureting engine, because the expansion ratio is reduced by the use of the dual cycle. The subject of mean effective pressure in Diesel engines has been much contested for years among Diesel-engine builders. Attempts have been made to establish a standard of mean effective pressure. The fact of the matter is that an air-injection Diesel engine using natural aspiration and a true Diesel-cycle has a limiting brake mean effective pressure of about 80 lb. per sq. in., beyond which it is difficult to go. Some of the semi-Diesels have been limited to 45 and 50 lb. per sq. in. b.m.e.p. A carbureting engine today easily develops 110 lb. per sq. in., b.m.e.p., and some as high as 140 lb. per sq. in., with even higher records. So, the air-injection Diesel seems to have a further handicap in weight per horsepower of from 80 to 110, and up to 140 lb.

For several years attempts have been made to increase the mean effective pressure in Diesel engines. Ten years ago, to get 75 lb. per sq. in. was an effort. A study of the theoretical limits of the mean indicated pressure, when the dual cycle is used, offers encouragement. An analysis has been made with the following assumptions: 350 lb. per sq. in. gage adiabatic compression-pressure with an exponent of 1.35, which is comparable with engine performance; 100 per cent volumetric efficiency, the fuel charge to be chemically correct for complete combustion, no excess air, and sufficient oil to be burned at constant volume to raise the pressure at top dead-center to 700 lb. per sq. in., and the combustion to be continued at constant pressure until it is complete; the expansion to be adiabatic, using the mean gas-constant as exponent, which shows a theoretical mean indicated



Note how the connecting rods are especially designed and constructed to give maximum strength on minimum weight. The pistons are of nickel-aluminum alloy of Bu-nite design and construction

pressure of 245 lb. per sq. in., which we can approach but never reach, as there are losses due to radiation, dissociation and excess air. The theoretical indicated thermal efficiency is 45.6 per cent, corresponding to a fuel consumption of 0.308 lb. per i.hp-hr.; at 84 per cent mechanical efficiency, the fuel consumption is 0.366 lb. per b.hp.-hr.

If the above figure of 245 lb. for the theoretical limit of the mean indicated pressure is corrected for the losses we know to exist: namely, radiation, 20 per cent; excess of air, 10 per cent; volumetric-efficiency loss, 10 per cent, we must first correct for volumetric efficiency, namely, $245.00 \times 0.90 = 220.50$ lb. Then correcting for the excess air required, we have $220.50 \times 0.90 = 198.45$ lb.

Many engineers, particularly European engineers, consider that 10 per cent excess of air is not enough. Carbureting engines, however, have probably exceeded this amount. By correcting the foregoing

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figure for losses by radiation, we have 198.45 × 0.80 = 158.70 lb.

Cards taken from engines having natural aspiration that Mr. Treiber has built show that the indicated pressure approaches the limits outlined. One showing 160 lb. mean indicated pressure either had higher volumetric efficiency or used more than 90 per cent of the air. The exhaust was clear. Correcting the theoretical indicated thermal efficiency of 45.6 per cent, which is equivalent to 0.308 lb. of fuel per i.hp.-hr., and using fuel with the low heat-value of 18,500 B.t.u., we have the correction for radiation losses, 20 per cent, and for mechanical losses, 16 per cent, bringing the fuel consumption to 0.43 lb. per b.hp.-hr.

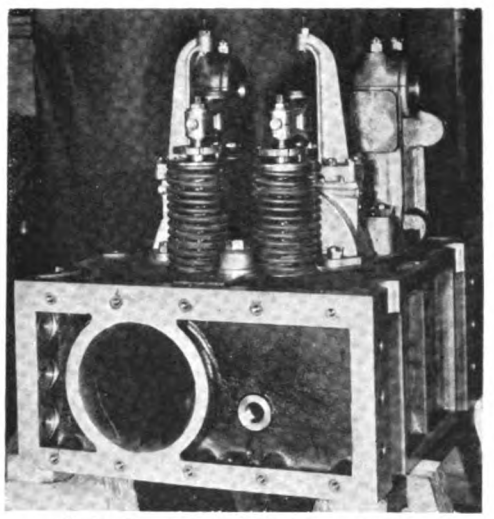
In practice, as is to be expected, we find that the fuel consumption is reduced as the mean indicated pressure is reduced, and the amount of fuel burned at constant volume is maintained constant; in other words, by reducing the "lap" and maintaining the "lead" of the fuel spray. Mr. Treiber has records of economy as low as 0.34 lb. per b.hp.-hr., but the brake mean effective pressure was low, being about 80 lb. per sq. in.

Thus, we see that it is possible to obtain mean effective pressures equal to those of the carbureting engine, but the higher initial pressures will always make it necessary for the Diesel engine to be inherently heavier, with heavier reciprocating parts; and this again is a barrier to speed.

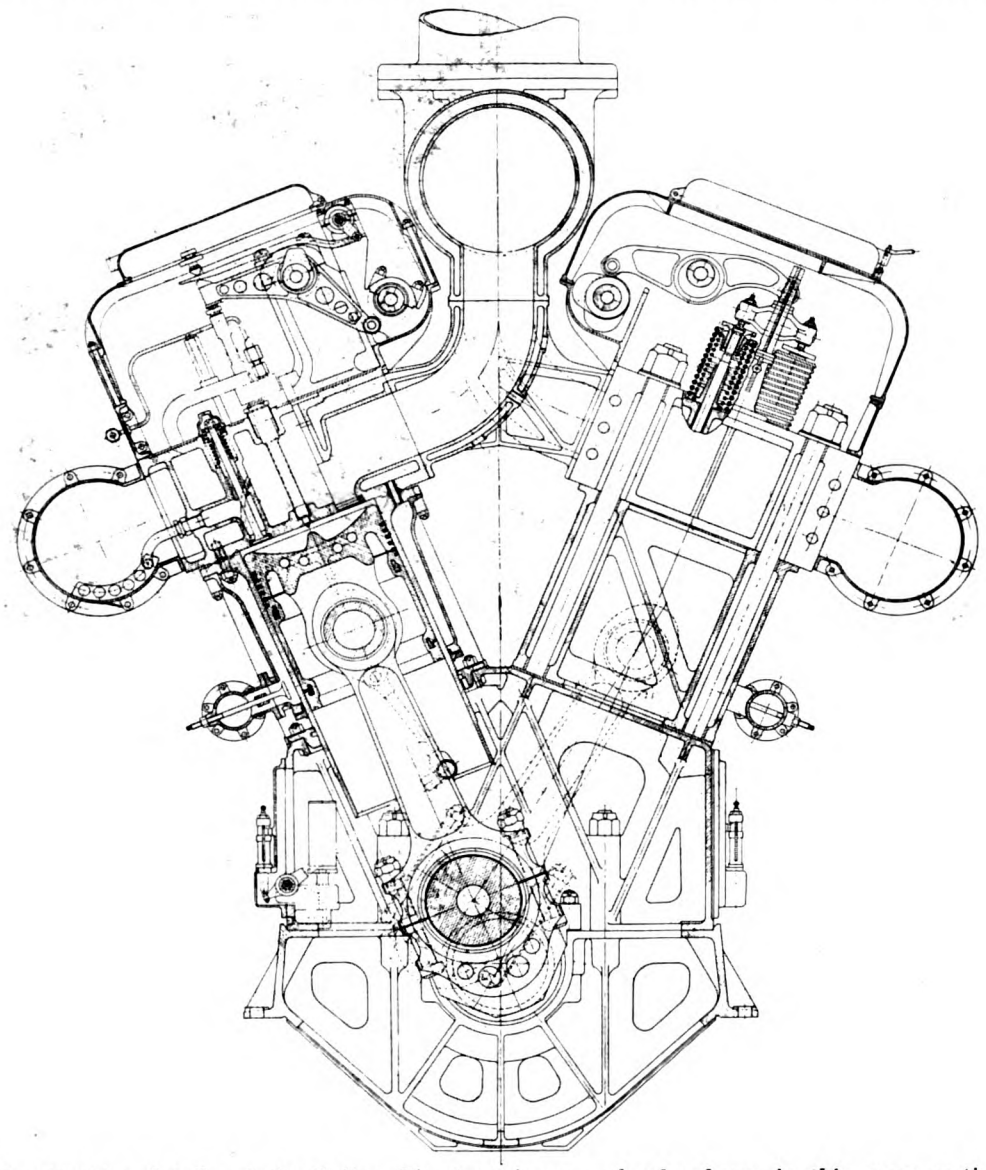
The speed is limited for two reasons: the first, mechanical, as noted, and the second, more important in small engines, by the time-lag of fuel ignition.

In a Diesel engine, a highly volatile fuel-oil must be converted from a cold liquid-condition into a finely divided or atomized state and its temperature must be raised to a point at which the hydrocarbon atoms unite chemically with the oxygen in the air charge. This is the crux of many limitations. As yet it is not known how to convert the fuel successfully into such a state before it is injected into the air charge. The greatest inherent difficulty in doing so is the decomposing of liquid fuel-oil while being converted into a gaseous state. If a way is found to convert heavy liquid fuel-oil into a gas without breaking it down, decomposing it, or freezing the carbon, there will be available a solution to the burning of oil in cylinders that will put the Diesel engines of today into the discard; but the nature of the oil cannot be changed.

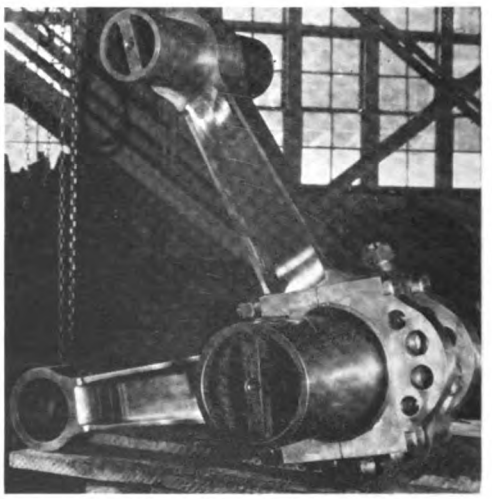
A very significant feature of construction of this new Diesel engine is the complete elimination of cast-iron just referred to, and effected in such a manner as to reduce the weight without sacrificing the necessary and important elements of strength and rigidity. This has been accomplished by a well-knit design in which steel tie-rods extend from the top of the cylinder head down through a set of aluminum alloy distance pieces and into the cast-steel framing, thus placing the high tensile members in tension and the low tensile ones in compression. The top of the engine is well tied together with cylinder heads in square section, accurately fitted and bolted together so as to form a long beam extending from end to end of the engine. These cylinder heads are made of aluminum-bronze and the cylinders are of forged chrome Vanadium, heat-treated steel with a hardness of 275 Brunell. The cylinder liners are securely bolted to the cylinder head, guided in the engine frame and free to expand downward. Cylinder jackets are of aluminum alloy in one piece which in turn is attached to the cylinder liner at the top and free to expand longitudinally at the bottom. By this arrangement there is no water joint in the crankcase, eliminating the possibility of oil contamination through leakage of water. Nickel-aluminum pistons are used in which the cooling system is cast integral with the piston crown and provides for oil circulation under pressure. They were designed and made by the Butler Mfg. Co. in collaboration with Mr. Treiber. This makes for light construction, a feature which is also carried out in the connecting rod design which is of the fork and blade type, forged of chrome vanadium steel and machined to H section with smooth wiping finish. The bearings are a very much refined type as compared to the usual engine practice. Forged steel is used in the bearing shell construction. It is normalized and lined with one sixteenth inch of bearing,



Cylinder head is of box form.



Construction details of the Triber Diesel engine are clearly shown in this cross section



Connecting rod assembly

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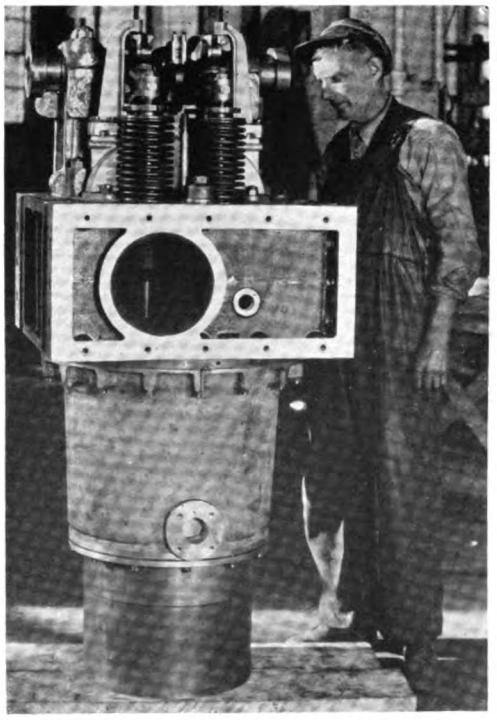
metal, without anchor grooves, thus forming a very rigid bearing, which permits much heavier loads than is customary with the conventional type of bearing.

Of unusual interest are the overhead camshafts driven with spiral spur and spiral bevel gears made of alloy steel, case-hardened and ground, and operated in Timken roller bearings. The camshafts assembly, rocker arms and all valve-operating mechanisms are enclosed in an oil-tight aluminum-alloy casing with small removable inspection covers securely dogged down on the top. All moving parts enclosed by this cover are pressure lubricated with return flow of oil to the main lubricating system. The entire mechanism is absolutely silent in operation.

Throughout the engine special metals have been used including a great many drop forgings of chrome-vanadium heat treated to high physicals, and a number of duralumin drop forgings as well.

The control wheel is located on the front of the engine and arrangement is made to start, stop and accelerate with one motion of the wheel. Reversing is done pneumatically by a dash pot and ram, the cylinder of which is manganese-bronze and pistons and rods of stainless steel. The fuel-oil system is of the constant pressure type with pumps driven by the main engine and fuel valves operated by the camshaft and enclosed in the housing over the top of the engine. A thrust-bearing of double self-aligning, full floating Timken roller bearing type is carried in a cast-steel housing.



Cylinder head, cylinder and liner unit

A common exhaust pipe serves both sets of cylinders and is located between the cylinder heads while the air inlet manifolds are attached to the outside of the cylinder heads and extend from end to end of the engine. Examination of the cylinder heads reveals an easy sweep and ample passage for air and gases to and from the valves, which makes for thorough elimination of the products of combustion and high volumetric efficiency amplified with a four valve arrangement.

Simplicity of operation has received special attention, an example of which is the manner of lubricating the entire engine with a pressure system thereby eliminating the need of hand oiling.

The first of the two engines has been under test connected to a Heenan-Froude dynamometer, and has functioned perfectly while giving the desired amount of power. Due to the excellent grade of workmanship, and material of the finest quality obtainable, a perfect test has resulted. It is significant that this engine has tested out and performed satisfactorily without requiring any changes whatsoever. Furthermore it was not necessary to take anything apart for repairs, replacement or adjustment. At the end of 80 hours of test operation the engine was found to be in perfect condition.

A pair of smaller engines of the same design are nearing completion for installation in Harold S. Vanderbilt's high-speed yacht, now under construction at the Herreshoff plant at Bristol, Rhode Island.

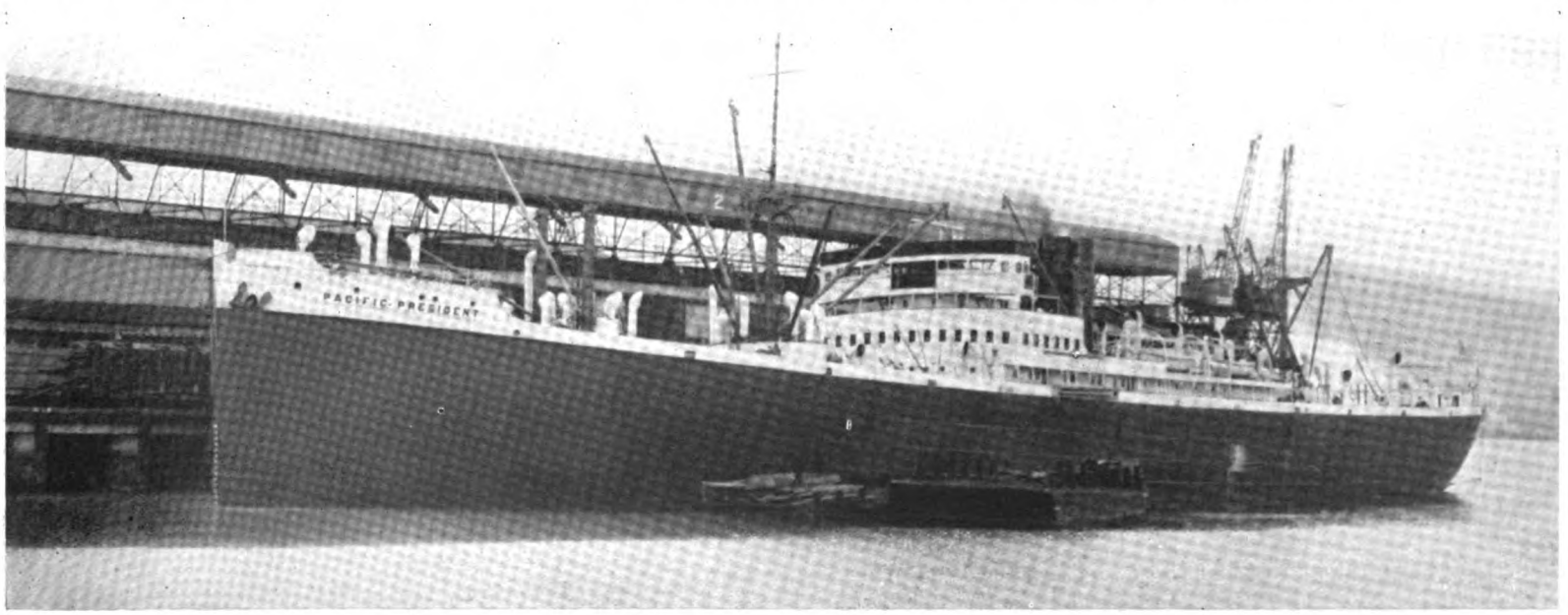
European Motorships in Pacific Trade

THE Furness-Withy program of building six new motorships for Pacific trade with a deadweight capacity of 10,000 tons each and sea speed of 13 knots is now completed. The first of these boats, it will be recalled, was the PACIFIC RELIANCE, which was put in service last year. She was followed by the PACIFIC ENTERPRISE and PACIFIC PIONEER. In April of this year the PACIFIC PRESIDENT made her first voyage touching at ports between Panama and Vancouver, B. C. Two later ships, the PACIFIC EXPORTER and PACIFIC GROVE are also on their way out.

The PACIFIC RELIANCE and three sister ships were built by the Blythswood Shipbuilding Co. of Glasgow and each is equipped with an eight cylinder four-cycle Kincaid-B. & W. Diesel engines built at Greenock. The cylinder diameters were 29.80 in. and the stroke 51.18 in. developing a total of 4200 s.h.p. at 115 r.p.m. These are twin-screw vessels 435 ft. b.p., 60 ft. beam and 42 ft. moulded depth.

The PACIFIC PRESIDENT is the first of two ships built to slightly larger specifications by the Deutsche Werke of Kiel, Germany, and having A. E. S.-B. & W. four-cycle Diesel engines. They measure 450 ft. b.p., 60 ft. 6 in. beam and 42 ft. 6½ in. moulded depth to shelter deck. Deadweight tonnage is 10,000 tons.

Sharples centrifuges are used for both fuel and lubricating oils. The fuel-oil is heated in a settling tank before passing through the centrifuge, and then is pumped into a service tank. The chief engineer expresses himself as well pleased with the results of centrifuging the fuel. He also states that the main engines are heavily constructed and built to last. Steam from the exhaust-gas boiler is used for heating the ship. Accommodation for 12 first class passengers is furnished in the same style as the PACIFIC RELIANCE.



Fine modern American-built motorships like the Pacific President unfortunately are conspicuous by their absence on the high seas. It's never too late to start building!

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Diesel-Electric Drive and Yachts

A Discussion of Some of the Outstanding Features and Advantages of the All-Electric Cruising Yacht

By Robert W. Clark*

TODAY the total number of marine electrical propulsion installations in the world has grown to 80, of which 77 are in the United States. The list of Diesel-electric vessels now includes, in addition to yachts, cargo vessels, tankers, dredges, tugs, river towboats and ferries. Diesel-electric drive consists essentially of a Diesel engine directly connected to an electric generator. One or more of these units supply power to a propulsion motor which is directly connected to the propeller shaft. In the case of vessels having more than one screw, a propulsion motor is connected to each.

In addition to the main generators and motors, a smaller generator is necessary, which is also directly connected, as a rule, to the Diesel engine. This generator is known as the exciter, and its function is to furnish electric current to the field coils of the main generator and propulsion motor. Although the exciter furnishes constant voltage to the motor field, the electric current to the generator field is first led through a reversing rheostat by means of which the direction and intensity of the excitation is controlled, thereby regulating the speed and direction of rotation of the propulsion motor.

In most installations, the exciter also furnishes auxiliary power when the vessel is under way, thus eliminating the operation of an auxiliary generating unit while cruising. The number of exciters depends upon the number of generating units as well as the auxiliary load they are required to carry.

This method of speed regulation, which is known as the variable voltage control, makes it possible to control the vessel from the bridge or deck, as the reversing rheostat, carrying the comparatively small field current, can be located wherever desirable.

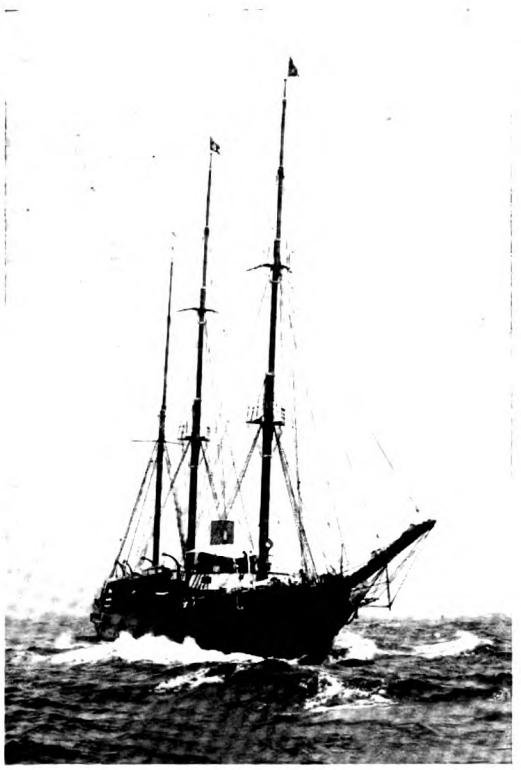
Such control is particularly advantagous to yachts or other craft operating a large part of the time in congested waters, due to the fact that it practically permits the same ease of maneuvering as a small motorboat or automobile. It also allows in certain cases a reduction in the engine room crew, thereby cutting operating expenses and permitting smaller crew's quarters.

An important advantage, however, of Diesel-electric propulsion for certain types of yachts is its adaptability of machinery arrangement to restricted engine room spaces. As a Diesel-electric installation consists of several small units, and as no mechanical connection is necessary between the generator units and the propulsion motor, the various pieces of equipment can be distributed advantageously with a resultant increase in space for living quarters. This flexibility of machinery arrangement also permits a better distribution of weight, giving greater stability through a lower center of gravity. This adds to the comfort of those on board by decreasing the rolling of the yacht in heavy weather.

The absence of dirt, cinders and soot, incidental to steam driven vessels burning coal or oil, is another advantage of Diesel drive of any type which appeals strongly to yachtsmen.

In the operation of auxiliary machinery while the yacht is under way, Diesel-electric drive differs from direct Diesel drive in that power for the auxiliaries can be taken directly from the main generating units, while with direct Diesel driven vessels auxiliary power sets are necessary.

The first Diesel-electric yacht installation was completed by the Westinghouse Company in 1920 in the schooner yacht ELFAY, a vessel of 313 gross tons, owned by Russell A. Alger, Jr., of Detroit. This installation consisted of one 115 b.hp. Winton Diesel, driving a 75 kw., 125-volt generator and a 9 kw. exciter at 425 r.p.m. The propulsion motor developed 90 hp. at 360 r.p.m. and gave the yacht under power alone a speed of 8½ knots.

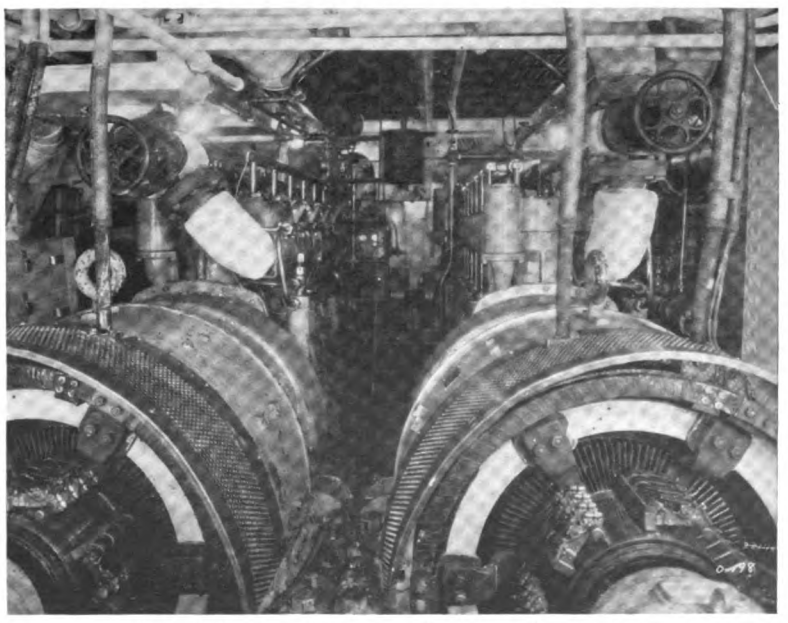


There is beauty in the auxiliary Diesel yacht.

In 1921 the auxiliary schooner yacht GUINEVERE was converted to Diesel-electric drive. The GUINEVERE is a 3-mast schooner-rigged vessel of 508 gross tons and is owned by Edgar Palmer of New York. The equipment consists of two Winton Diesels of 350 b.hp. each, which drive two 225 kw. generators and two 15 kw. exciters at 225 r.p.m. The yacht has a speed of 11.35 knots and is driven by a 550 hp. motor at 220 r.p.m.

The yacht ALCYONE, of 455 gross tons, which is owned by Henry W. Putman of New York was converted to Diesel-electric drive in 1922. This installation consists of two Winton Diesels of 210 hp. each, driving two 140 kw. generators and two 15 kw. exciters and one double armature motor developing 350 hp. at 175 r.p.m. Under power alone the yacht has a speed of 11 knots.

During the same year, 1922, Diesel-electric propulsion was installed in the yacht VALERO II. This vessel is of 220 gross tons and is owned by Captain G. Allen Hancock of Los Angeles. There are two main generating units, each driven by a 135 b.hp. Diesel.



Diesel-electric drive is quiet and vibrationless

*Westinghouse Company.

Two Motorvessels Launched at Montreal

An interesting event was staged May 23rd at the plant of Canadian Vickers, Ltd., Montreal, in the launching of two motorvessels. The new craft are the FOUNDATION JUPITER and DONNACONA No. 1, owned by the Foundation Company of Canada and Donnacona Pulp and Paper Mills, respectively.

The FOUNDATION JUPITER was constructed for service on the North American seaboard and the Gulf of St. Lawrence. She is a steel vessel with a cargo capacity of 400 tons and carries what is probably the largest ship's derrick in Canada, capable of lifting a weight of 50 tons. The hull is 140 ft. long, 35 ft. beam and carries a draught of 11 ft. 6 in. In addition to other innovations she is equipped with two clam shell buckets for dredging purposes.

We do not have full particulars of the machinery equipment but understand that the main propelling units are two Kromhout surface-ignition engines with a combined power of 400 b.hp. The vessel is expected to enter salvage and general sevice work on Trinity Bay as soon as the speed trials are finished, which should take place the first week in June.

A few minutes after the FOUNDATION JUPITER had been successfully launched and taken in tow by the waiting tug, a second motorvessel left the slips. It was the DONNACONA No. 1.

Officials of the Canadian Vickers Ltd., Foundation Company of Canada and the Donnacona Pulp and Paper Mills were present with wives and families in addition to a number of guests.

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A New Yacht Type of Steering Equipment

Change-over, at the Pilot House, Makes Instantly Available Three Dependable Methods of Steering

OLD helmsmen say, "It is all right to write a few Ss with the wake but no Os." A straight white ribbon tapering off astern to mingle with and fade into the sea is a matter of pride to some, but not all, of them. On commercial craft this is a question of dollars and cents; on yachts it is that and a little more. We may expect to find, on the latter, the most up-to-date and efficient equipment, and every modern device which may contribute to the comfort of the owner and his guests. This can never be with, cumbersome, clanking old chains and rattling steering engine, reminiscent of tramp-steamer days.

Realizing this, the Sperry Gyroscope Co. has developed the Sperry Triple Steering System, which may be used on yachts of all sizes. Utility dependability, convenience and simplicity are special features; but comfort aboard is an added advantage. A yacht that is badly steered will fall off her course and roll in heavy weather. By eliminating the human element in steering the amount of "yaw" is reduced with a characteristic increase in stability and comfort.

This new steering system is unique. The control unit—in addition to the electrical control mechanism housed therein—has a large steering wheel mounted on it which connects through a jaw-clutch, to shafting so that it may be disconnected during follow-up or automatic steering.

A single lever with three latched positions provides for all control functions. Automatic steering is accomplished with this lever on "Gyro," in which position the gyro-compass controls the steering engine, to supply corrective helm as required and keep the ship very accurately on her course. A small pilot wheel functions as a vernier for small adjustments and changes of course, which permits a maximum of steering efficiency to be obtained, under all conditions of wind and weather.

Electrical hand steering is accomplished with the lever on "Hand" position in which the automatic feature is disconnected and the rudder follows, when the pilot wheel is turned in the usual manner.

By placing the operating lever on "Off" position and connecting the large steering wheel an emergency means of steering is instantly made available, through the regular shafting and wire rope system; the electrical device is then out of function.

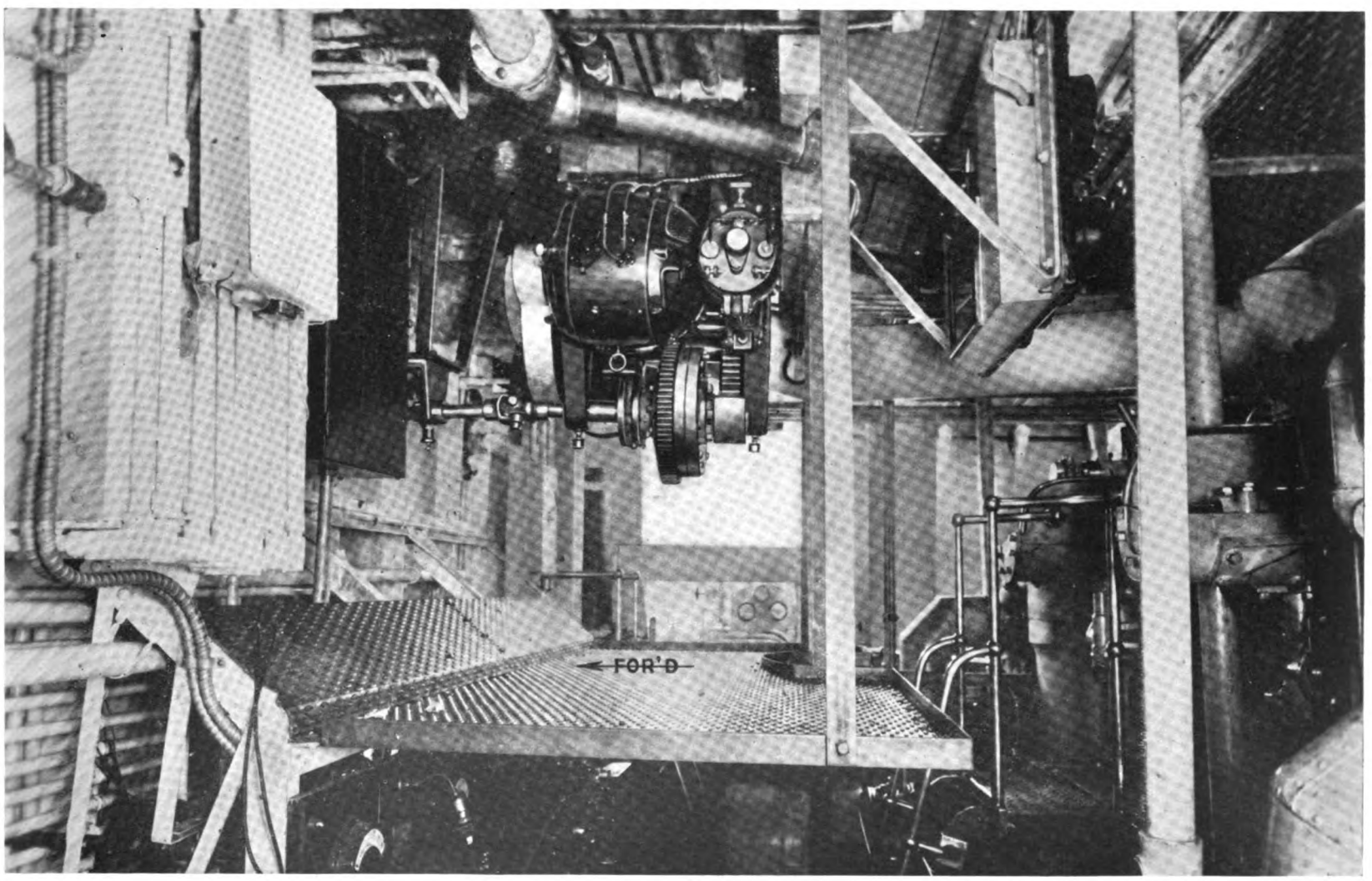
The steering gear can be any one of a number of types, conveniently mounted in the engine room, with wire ropes leading to the rudder quadrant. It is electrically controlled from the bridge.

Housed in a non-magnetic, durable aluminum binnacle are the mechanisms necessary for automatic and hand electric steering, they consist of a roller-carriage and set of follow-up rings, which follow up the movement of the carriage and bring an insulated segment of the rings into fixed position with the carriage. The entire assembly constitutes the control unit.

The shafting from the steering engine to the control unit is utilized to control the movement of the follow-up rings and causes the latter to move in a manner exactly corresponding to the movement of the steering engine.

The follow-up rings follow the movement of the roller and open the circuit when they overtake it, as the result of the movement imparted by the steering engine. The result being that the steering engine movements or amount of helm applied are proportional to the distance through which the roller carriage has been moved.

Either automatic or hand electric steering controls the movement of the roller carriage which is suitably connected,



Steering gear suspended from underside of deck in engine-room of Diesel yacht Caroline

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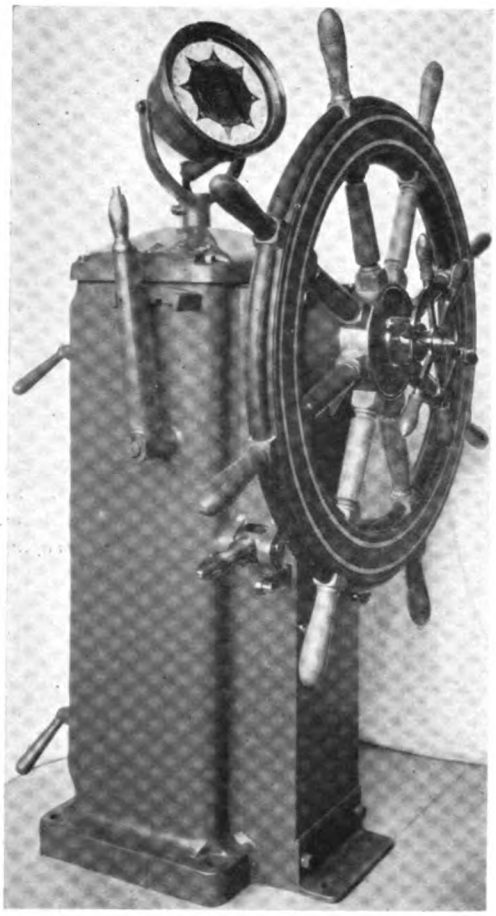


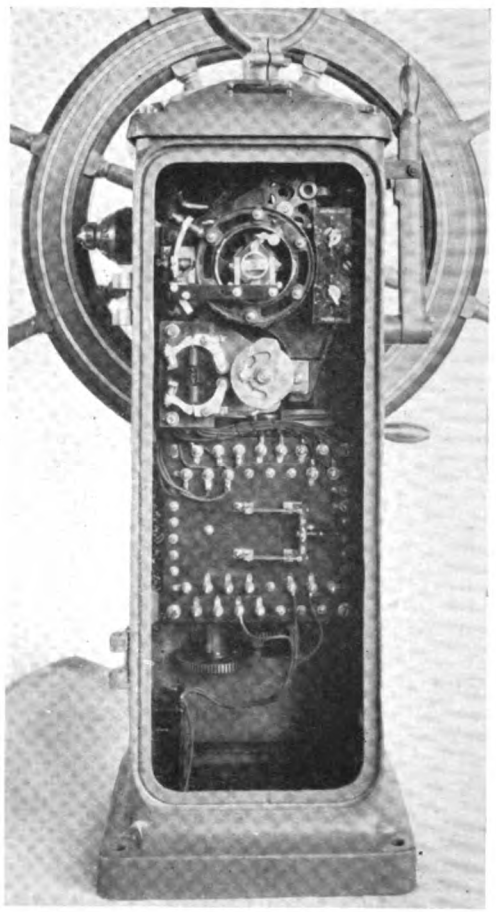
Non-magnetic aluminum binnacle

through differential gearing, to a repeater that is a part of the gyro-compass system and is also connected to the small hand electric steering wheel. For hand electric steering the repeater is locked so that it moves with the hand wheel: During automatic steering the repeater is unlocked so that any variation of the ship—from the base line maintained by the gyro-compass—causes the roller carriage to be stepped around, thus controlling the steering engine and applying the necessary corrective helm, to keep the ship on the desired course,

The steering engine consists of an electric motor, gearing, an electric clutch, and a means of transmitting linear motion to the tiller-cables. Worm gears, when used, are self locking; when they are not used an electric brake is employed to prevent the rudder from taking charge when the steering engine is at rest.

The electric clutch performs two very necessary functions. By virtue of a predetermined torque it will slip, definitely limiting the load that can be applied upon the wire rope and steering engine, in the event of the rudder becoming fouled or a heavy sea striking it. It also provides a means of disconnecting a portion of the steering engine, making emergency manual control instantly available from the bridge.

Engineering and mechanical characteristics of the Sperry Triple Steering system have been nicely worked out.



The electrical control mechanism

Mess Room Maxims and Fables

Where there is smoke at the exhaust there must be some fire in the cylinders, but it may be only a smudge.

By stopping the cooling water you may start a steam pocket, and by starting the water you may stop the steam pocket and so break a cylinder head casting.

Dead-front switch boards have live backs, which is quite shocking to ones who attempt to sleep on their—the switch boards'—back.

It is time that the man who thinks it impossible to keep the engine-room of a motorship in first class condition pays a visit to one of the Shipping Board Diesel conversions. We have the first one to find that is dirty.

Failing to disengage the jacking gear before starting the engine may result in a permanent breach of diplomatic relations between the engineer and the marine superintendent.

Certain engineers run all of the machinery on the ship but others are run by the machinery; run off, that is!

It would not injure the chap who is always kicking about the grub, the quarters, the pay, the work, the run, the ship, the company, the sea, the rest of the crew, the skipper, the chief, the short stops in port and the long time at sea; to go ashore and stay until he is glad to get back to the sea and hold his peace.

One advantage of clearing the bilges of rags by cleaning the basket strainers is that you do not have to hunt for the rags in so many different places.

What becomes of the shrinkage when you use a wad of waste to wipe the inside of the crank pits?

The first assistant works hard to keep the job looking well, the owners come aboard and express approval of the way it looks, and the chief engineer gets all the credit.

This is just one of the incentives for the First to hurry up and get a chief's job.

One sort of a *nut* can always free a nut that is stuck fast, by using a chisel and hammer. No need for the chief to hit that "nut" with a hammer as he already is cracked.

He is like the oily gink that cleans the compressor breather with kerosene while the engine is running, and bang goes a cooling coil.

Compound Troubles

When a valve leaks, the worse it leaks, because the worse it leaks the more it leaks. When a bearing knocks the worse it knocks because, the worse it knocks the more it knocks. When a piston seizes the worse it is, because the worse it is the tighter it seizes. When a bearing is dry the hotter it becomes, because the hotter it becomes the dryer it becomes, and the dryer it becomes the hotter it becomes.

The New Diesel-Electric Lightship

The Albina Marine and Iron Works, of Portland, Ore., is preparing to build three Diesel-electric driven lightships for the Department of Commerce, according to announcement by the Oregon firm. These will be sister ships, two for the Atlantic Coast and one for the Pacific. They are the first Diesel-electric drive lightships to be built and each will be 133 ft. 3 in. over all, with beam of 30 ft., depth of 15 ft. and displacement of 630 tons. Diesel power has been chosen because, since these small ships have to remain at their posts six months at a time without refueling, economy of fuel transportation is of great importance. With the Diesel power plants, too, it will be unnecessary to keep fires going at all times as was needed to maintain steam in boilers. The new and interesting lightships are to be completed this year. Type of Diesel to be used has not been made public, but the General Electric Company will supply all propulsion and auxiliary generators, motors and other electric equipment.

A. C. Hardy Reads Paper

A C. Hardy, for the last 18 months Editor of MOTORSHIP, and now in Europe, recently read an interesting paper entitled "The Shipowner and The Motorship." This will be reproduced in full in the July issue of MOTORSHIP. Mr. Hardy plans to contribute to MOTORSHIP from time to time, including his experiences crossing the Atlantic on the Diesel liner GRIPSHOLM.

To care for the increasing demand for Pacific Coast perishable goods in Argentina and Brazil, the Westfal-Larsen Line announced that it will immediately construct refrigeration facilities for 1500 tons.

The Atlantic and Pacific Trawling Company of Boston, Mass., have placed an order for six 60 Hp. Colo Diesel engines for use as auxiliaries on the three steel Diesel trawlers which are being bulit.

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140,000 Tons of Motorships Ordered from One Yard

Including Five Double-Acting Diesel Cargo-Passenger Liners for Refrigerator Service

MOTORSHIP building continues to occupy premier place at Harland & Wolff's great shipyard in Belfast. With the launch on May 22 of the YAMANOTA, the last of the five tankers building for the Lago Shipping Co., the company has now nothing on hand in the stocks except Diesel tonnage, of which it has about 120,000 tons under construction in the three yards in Belfast.

In addition, they will lay down in June the keel of a 20,000-ton passenger motorship for the Union-Castle Line, or a total of 140,000 tons. It has been decided, however, that the intermediate class Union-Castle motorship, recently ordered, is to be built in the H. & W. Govan Yard, where there is already under construction one of the four big motorships ordered from Harland & Wolff by the Nelson Steam Navigation Co., the first of which—HIGHLAND MONARCH—was launched in Belfast on May 3rd.

The principal vessel under construction is the 26,000-ton White Star Liner OCEANIC, and next in point of size comes the 20,000-ton motorship for the Union-Castle Line, which is in addition to the one to be laid down. Then there come the said four 14,450-ton motorships for the Nelson Line, and three passenger motorships for the Belfast Steamship Company's Belfast-Liverpool service, while there is one motorship on the stocks for the King Line, London, and two at the finishing wharves. It will thus be seen that Diesel tonnage has almost superseded steam tonnage, so far as Harland & Wolff are concerned.

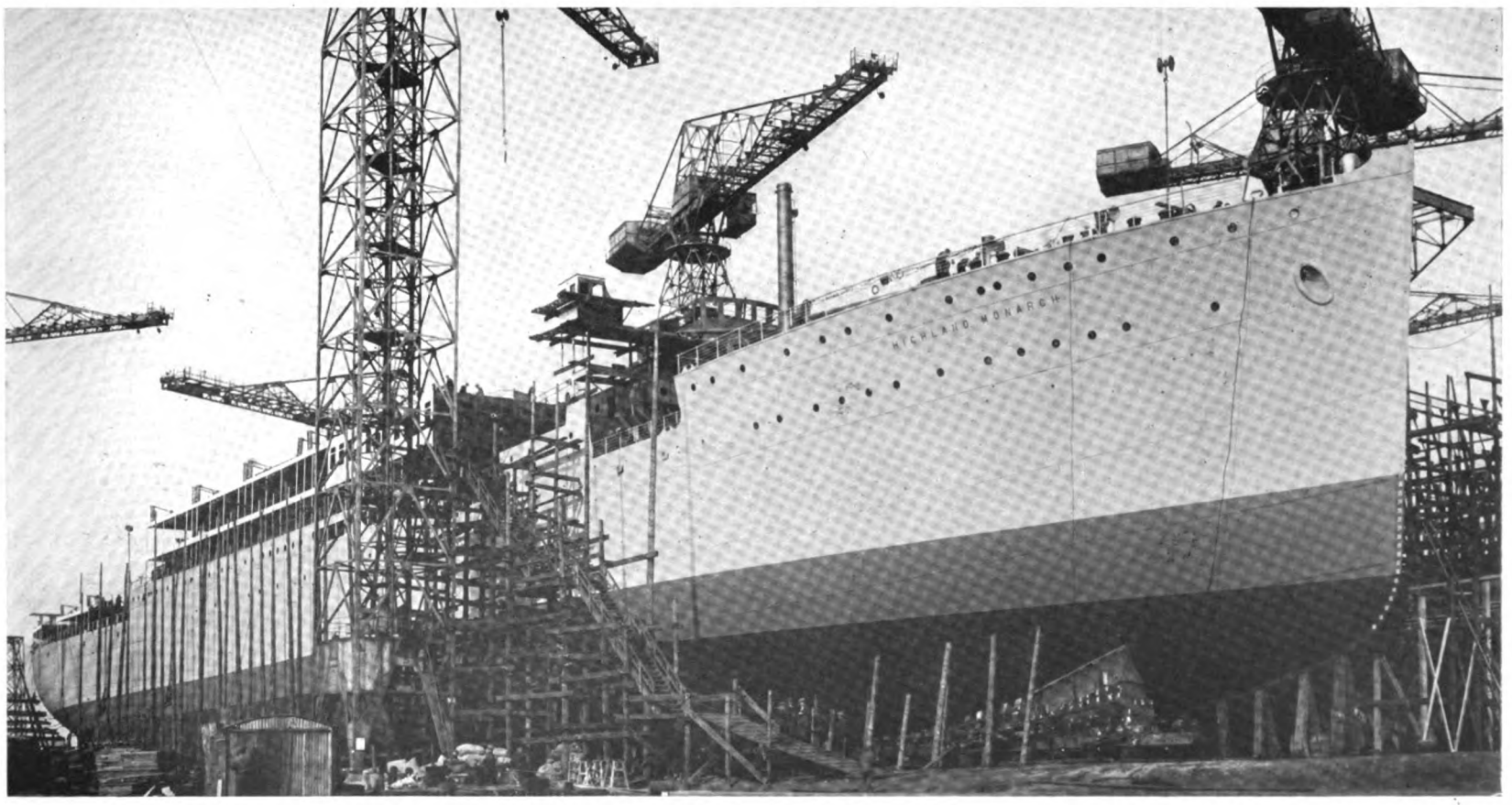
The Belfast shipyard of Workman, Clark (1928), Ltd.—builder of the MS. BERMUDA—reopened on May 1st, intends to go after more Diesel tonnage, as well as steamship tonnage, and it is already in the market in answer to inquiries from various American and British owners, including the Standard Fruit Company of New Orleans, which intends to have either three or five vessels built in Europe.

With reference to the projected White Star motorliner of the super-Olympic type, which is to be built in Belfast, no steps have yet been taken in connection with the laying down of the keel. *Plans are ready*, but, in the absence of orders from the owners to proceed, nothing further will be done until Lord Kylsant gives the word.

Significance may be attached to the fact that the powerful combination passenger and meat carrying motorship HIGHLAND MONARCH was christened by Mrs. Cabell, wife of R. H. Cabell, a director of Armours of Chicago, and that T. D. Bowman, American Consul-General, was present at the launching. As just mentioned, this ship is one of five powerful, double-acting Diesel liners building for the Nelson Line's England-Spain-Portugal-South America service. Each vessel is of 14,450 tons gross, and in addition to 135 first-class, 66 second class and a large number of emigrants, carries refrigerated meat cargo in five insulated holds and in insulated 'tween decks.

Propelling power is furnished by two eight-cylinder, double-acting, four-cycle Harland-B. & W. Diesel engines, direct coupled to twin screws. For auxiliary power there are four 200 kw. Diesel generator sets. Exhaust gases may be used for firing the donkey boiler to provide steam for cooking and heating.

During the month of March, Harland & Wolff laid the keels in their South Yard at Belfast, of three passenger and cargo motor ships ordered by the Belfast Steamship Co., Ltd., one of the constituent companies of the Coast Lines, Ltd., headed by Lord Kylsant. These vessels are intended for the daily service between Belfast and Liverpool, and will replace the PATRIOTIC, HEROIC and GRAPHIC at present on that service. They are notable as being the first motor vessels to be introduced into the cross-Channel passenger service between Ireland and Great Britain, and it is expected that they will begin their runs in April, 1929. The total cost of the three vessels will, it is stated, be between $3,750,000 and $5,000,000. They will be 345 ft. long by 46 ft. beam by 19 ft. deep. The propelling machinery will consist of twin-screw, 10-cylinder engines, the total output of each installation being 6,000 b.hp. The machinery will be of the H. & W. B. & W. type and the speed required for the vessels is 19 knots. Three 6-cylinder Diesel generator sets are also to be installed.



Mrs. R. H. Cabell, wife of a director of Armours of Chicago, christened the Highland Monarch when she was launched on May 3rd at Harland & Wolff's yard. She is one of five Nelson Line 14,450 *gross tons, double-acting Diesel motorships now building*

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Interesting News and Notes From Everywhere

TWO Winton Diesel-engined tugs have just been ordered, one for the Pennsylvania R.R. and the other for the Long Island R.R. These railroad companies already have a number of Winton Diesel-engined tugs in service.

The Lake and Ocean Transit Company, newly formed, and which absorbed the Detroit & Lake Ontario Transportation Company, is planning building some Diesel tugs and barges.

Specifications are now being drawn up by the Commissioner of Canals and Waterways of the State of New York for a Diesel-electric ferry of about 350 hp. for operation between Wards Island and Manhattan.

The United Fruit Company of Boston has chartered for five years two Diesel motorships just ordered from the Götaverken of Gothenburg by Chr. Gundersen and by L. Harboe Jensen and Co. of Oslo, respectively.

In our May issue, page 396, an illustration showing the launching of the Swedish motorship KUNGSHOLM was referred to as at Kiel, which is incorrect. This vessel is building at Hamburg in the Blohm & Voss yard.

Two 180 h.p. Fairbanks-Morse Diesel engines are to be installed in the Motorship 104 owned and operated by the Erie and St. Lawrence Corporation, stated George D. McDonald, Vice-President of the company recently. The ship is now being fitted out at Ogdensburg, N. Y.

Word was recently received regarding the economy of operating the Diesel-driven ferry DEFIANCE, operating out of Tacoma, Washington. The vessel is equipped with a 360 Hp. Fairbanks Morse Diesel engine and uses on an average of 14 gallons of fuel-oil per round trip, or about 100 gallons per day. Her sister ship, an oil burning steamer, CITY OF TACOMA, burns 720 gallons of oil per day, or approximately seven and a half times as much as the Diesel powered ship, yet she carries exactly the same number of cars and passengers.

T. Orchard Lisle Now Executive-Editor and General Manager

T. Orchard Lisle, who has been conducting MOTORSHIP for so many years, has been made Executive-Editor of this Journal by the National Trade Journals, Inc., and will be responsible for both the editorial and business departments. Mr. Lisle's knowledge and experience, as well as his "background" have gained his recognition as a leading international authority on Diesel-driven motorvessels, their power equipment, their operation and their economic advantages. In his new capacity he will be able to exercise his qualifications to an even fuller degree than heretofore.

R. H. Ward Becomes Managing Editor

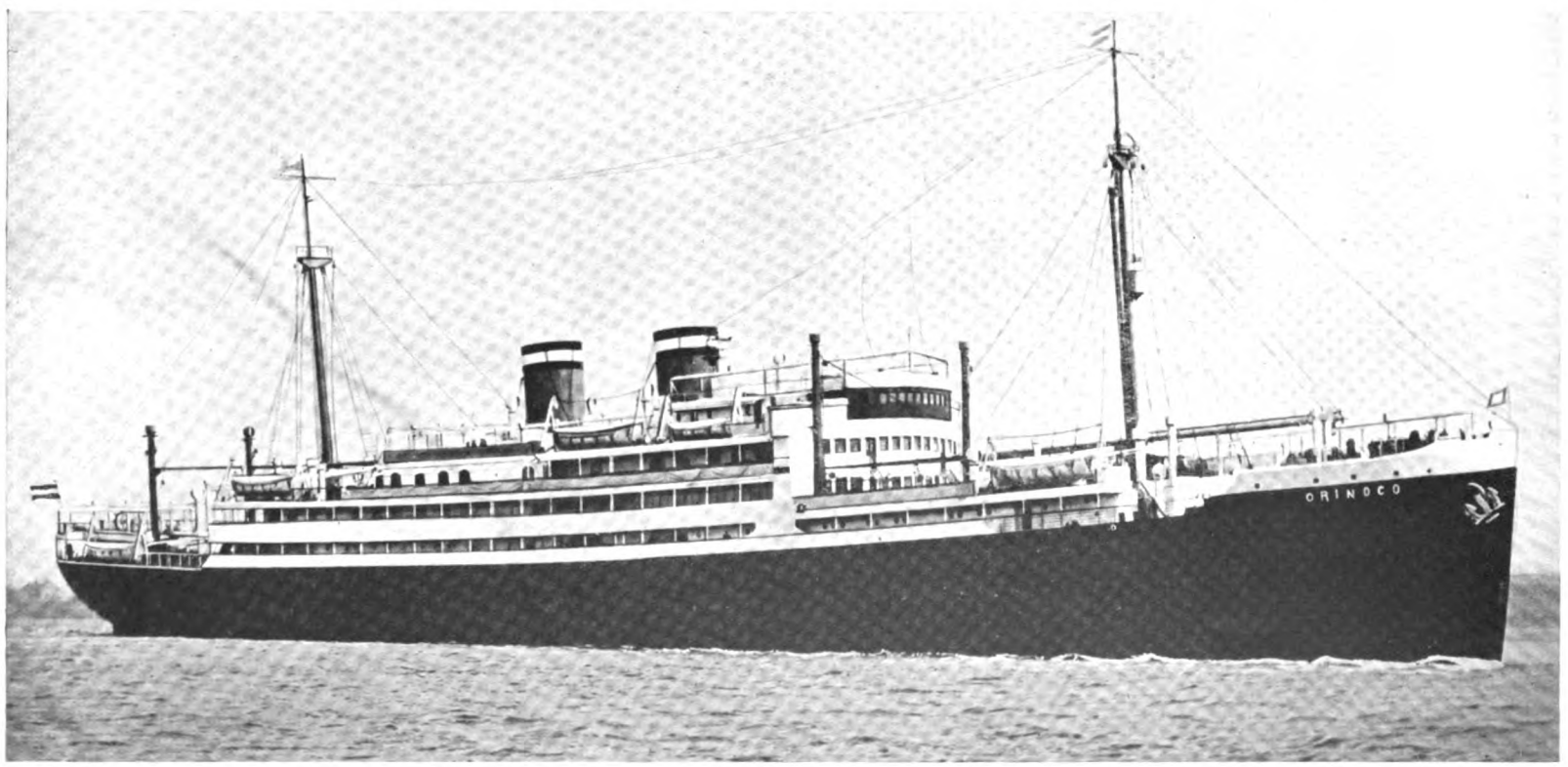
Roswell H. Ward, newly appointed Managing Editor of MOTORSHIP, was trained as an industrial engineer at Antioch College and served his technical apprenticeship in the Ward-Rochester shops and with the Engineering Division of the U. S. Army Air Service. After four years of research and production work with various manufacturing organizations he became Editor of the Oil Engine Power Plant Handbook in 1926 and Editor of OIL ENGINE POWER in 1927.

A. B. Newell Joins Motorship Staff

A. B. Newell, Associate Editor of MOTORSHIP, has had a long and varied experience as an engineer of motor vessels. Going to sea at the early age of 17, he obtained his chief engineer's license at 21 and during the period 1917 to 1923 was chief engineer of several ocean going motorships and spent five months as an Instructing Engineer under the Belgian flag. From 1923 to 1927 he was employed ashore and at sea in the development of large marine Diesel engines and since that time has been active in Diesel installation and development work. He has been a frequent contributor in the past to MOTORSHIP and OIL ENGINE POWER and is the author of several technical papers.

The Hamburg-American line motorship PORTLAND, of 9,500 gross tons, recently launched at Bremen for service on the Continental-Pacific Coast, will go on her run in June.

Tests have just been started at the Camden plant of the Treiber Diesel Engine Company on the two Diesel engines for the big Diesel yacht building at Herreshoff's for Harold S. Vanderbilt. Each engine is a 12-cylinder, V-model, 4-cycle unit of 750 b.hp. at 720 r.p.m. The yacht will have a speed of about 20 knots.



America needs many combination passenger-cargo motorships like the 9,450 tons, 15½ knot Hamburg-America Line ship Orinoco. She is on the Europe-West Indies service carrying 340 passengers, and is propelled by twin 3,300 s.hp. M.A.N. 8-cylinder, single acting Diesel engines. Congress has authorized the Shipping Board to present its recommendations for new ships of this type—Let's go!

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The Second National Fuels Meeting will be held in Cleveland, Ohio, Sept. 17-20, 1928. Papers are being prepared by some of the outstanding engineers and scientists in the fuel and power fields. Attendance to and participation in the meetings is not limited to members of the American Society of Mechanical Engineers, who are sponsoring the meetings.

A. S. Bergendahl, marine engineer of Houston, Texas, has worked out a plan for building and operating three Diesel-electric car ferry and passenger ships between Galveston, Texas, and New Orleans. The operating company will be known as the Union Gulf Line. Each boat will be propelled by twin electric motors and power furnished by six Diesel engines of 975 b.hp. each.

The launching of the motortanker GLITTRE at the Götaverken in Gothenburg took place last month. This is the sixth 9,000 ton tanker to be launched at this yard during the past twelve months. The GLITTRE is 407 feet long overall, and has a breadth and depth of 55 and 32 feet respectively. She is powered with two six-cylinder, four-cycle single-acting, Götaverken-B. & W. Diesels, developing 1,500 i.hp. each.

The Charles Ward Engineering Works of Charleston, W. Va. has a twin-screw Diesel towboat under construction, which will be powered with twin 360 hp., six-cylinder Fairbanks Morse two-cycle engines. The boat will have an overall length of 126 feet, a breadth and depth of 26 and 7 feet respectively. The completed ship will be delivered to the International Cement Corporation.

Work is progressing on the Shipping Board steamer DEFIANCE, now being converted to Diesel-electric drive at the U. S. Navy yard in Boston. Her sister ship the TRIUMPH is likewise being converted to Diesel-electric drive at the Norfolk Navy Yard. Both ships are of the Orleans class and will cost approximately $1,300,000 to convert. The third conversion, the COURAGEOUS is making excellent progress at the Federal shipyard, Kearny, N. J.

Contracts for the two new Diesel tug boats for the Pennsylvania Railroad and Long Island Railroad, respectively, referred to in the May issue of MOTORSHIP, have now been placed with the Pusey & Jones Corporation, Wilmington. When constructed, the hulls will be towed to the Pennsylvania Railroad yard at Hoboken, N. J., where two 6-cylinder, 14″ x 18″, 375 s.h.p. at 260 r.p.m. Winton Diesel engines will be installed in each boat. The boats are 105′ long overall by 24′ breadth and 13′9″ depth.

Contract was recently awarded the Bath Iron Works, for the construction of a 43-foot steel tug-boat built specially for shallow water service in South America. She is owned and operated by the Venezuelan-Gulf Oil Co., and though built on salt water in Maine, she will be hauled on a flat car to New York City. Then after a steamer voyage to Venezuela, she will be placed on another flat car and hauled to a lake in the interior of the country. The ship will be powered with a 50 h.p. Diesel engine and has a beam of 10 ft. 4 in. and a draft of 4 ft. 6 in. and a speed of ten knots.

Elmer A. Sperry, Chairman of the Board of Directors of the Sperry Gyroscope Co. of Brooklyn, N. Y., was nominated for the Presidency of the American Society of Mechanical Engineers. Election will be held on September 28, 1928.

Professor Ir. I. Franco, a director of Werkspoor, Amsterdam, builders of Werkspoor single-acting and double-acting Diesel engines, has been elected Managing-Director of the Company in place of Joan Muysken, Sr., who recently passed away. Professor Franco, before occupying his new position, was chief engineer of the Service for Material and Electric Traction and the Workshop of the Netherlands Railways.

The Messageries Maritimes of France have just placed an order with the Societe Des Atlers et Chautiers De La Loire for the construction of a 550-foot passenger-freight motorship to be named the FELIX ROUSSEL. The ship will be placed on the Marseilles-China-Japan run and will be powered with a pair of two-cycle Sulzer engines having a collective b.hp. of 10,000, in addition to five Sulzer Diesel auxiliary engines. With this power, the ship is expected to operate at about 16.5 knots speed. She will carry 900 passengers.

At the annual meeting held in London of the White Star Line, Lord Kylsant stated that the line now has under construction a motorliner in excess of 26,000 tons which will enter service in the autumn of 1929. This vessel will not be only the largest passenger ship engaged in the New York-Liverpool run, but will be the first motorship to enter that service. The company has for some time past been considering the construction of a super-liner for its Southampton service. This vessel will be the largest and fastest ever laid down.

Two Hill Diesel auxiliary generating sets were installed on the two new Diesel ferries, MOTTHAVEN and GREENWICH VILLAGE now building by the Todds Shipyard Corp., for service in the East River, New York City. They are of the four-cylinder four-cycle type, each cylinder having a bore and stroke of 5x7 inches and operating at 720 R.P.M. The feature of these sets is their single-point fuel distributor, which eliminates the necessity of manually adjusting the fuel supply to each cylinder. The distributor has but one small moving part and this is so delicately balanced that any slight change in pressure from the governor will cause instant response, thus giving very accurate regulation. The fuel is drawn from a small day tank and delivered to the fuel distributor under a pressure of 15 pounds by means of a small centrifugal pump and the surplus fuel returns to the day tank by gravity. Used oil is removed from the base by a separate pump and discharged into an outside reservoir provided with cooling coils, visual gauge and strainer. The engine and generator are connected by means of a Falk flexible coupling. The generators are direct current, 20 KW, 125 volt, and are manufactured by the Electro Dynamic Co. Each complete unit weighs 5400 pounds.

Following closely on the announcement of two new motorships to be chartered by the United Fruit Co., the Di Giogion Fruit Company of New York will shortly order two new motor fruit-carriers from a European builder for operation on their New York-West Indies run. The increasing importance of cool, compact power for fruit carriers operating in warm climates is one of the biggest factors in the conversion of the world's fruit carrying ships to Diesel propulsion.

An interesting story reaches us from an authentic source regarding an American Diesel-driven tanker that made a round trip to Europe. Owing to boiler and Diesel fuel prices being comparatively high in London, the chief engineer decided to return to the United States with the fuel left in the bunkers and take on new fuel at Key West en route to New Orleans. Due to running into bad weather, longer time was taken than was expected and the auxiliary-boiler fuel ran so low that the scum and residual muck got into the burners, which were unable to handle them. The Diesel fuel was turned over to the boiler and the Navy C fuel-oil dregs—which the boiler would not burn—were piped to the Diesel engine. This lasted about five or six days. The Diesel engines—although turning at 200 rpm.—successfully burned this oil, although a few valves were burned, and Key West was made with only 29 barrels of oil in the bunkers.

The scene apparently is laid once again for another mystery of the sea since disappearance of the Furness Line motorship ASIATIC PRINCE. She left Los Angeles on March 16th with a two million dollar cargo and a crew of about thirty men. She was due in Yokohama about April 2nd and to date no word has been heard from her. Whether or not a great tidal wave sank her, if her cargo listed and she capsized or if she rammed a derelict and sank, it may never be known. She is still among the missing as this issue goes to press. In the past there have been several other mysteries of the sea that remain unfathomable. Among the most recent was the disappearance of the U. S. Navy collier CYCLOPS. She was enroute to Australia and mysteriously disappeared somewhere in the South Atlantic and though it was over three years ago not a trace of her has ever been found. The British passenger steamer WARRATAH disappeared off the African coast under similar circumstances many years ago.

Two 6,000 b.hp. Sulzer Diesel engines have been ordered for a new submarine mother ship to be built for the French Navy.

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Diesel-Electric Fireboat Makes Big Savings

Port of Houston's New Style Firefighter Demonstrates Economy and Efficiency in First Year of Service

By R. W. Crowly

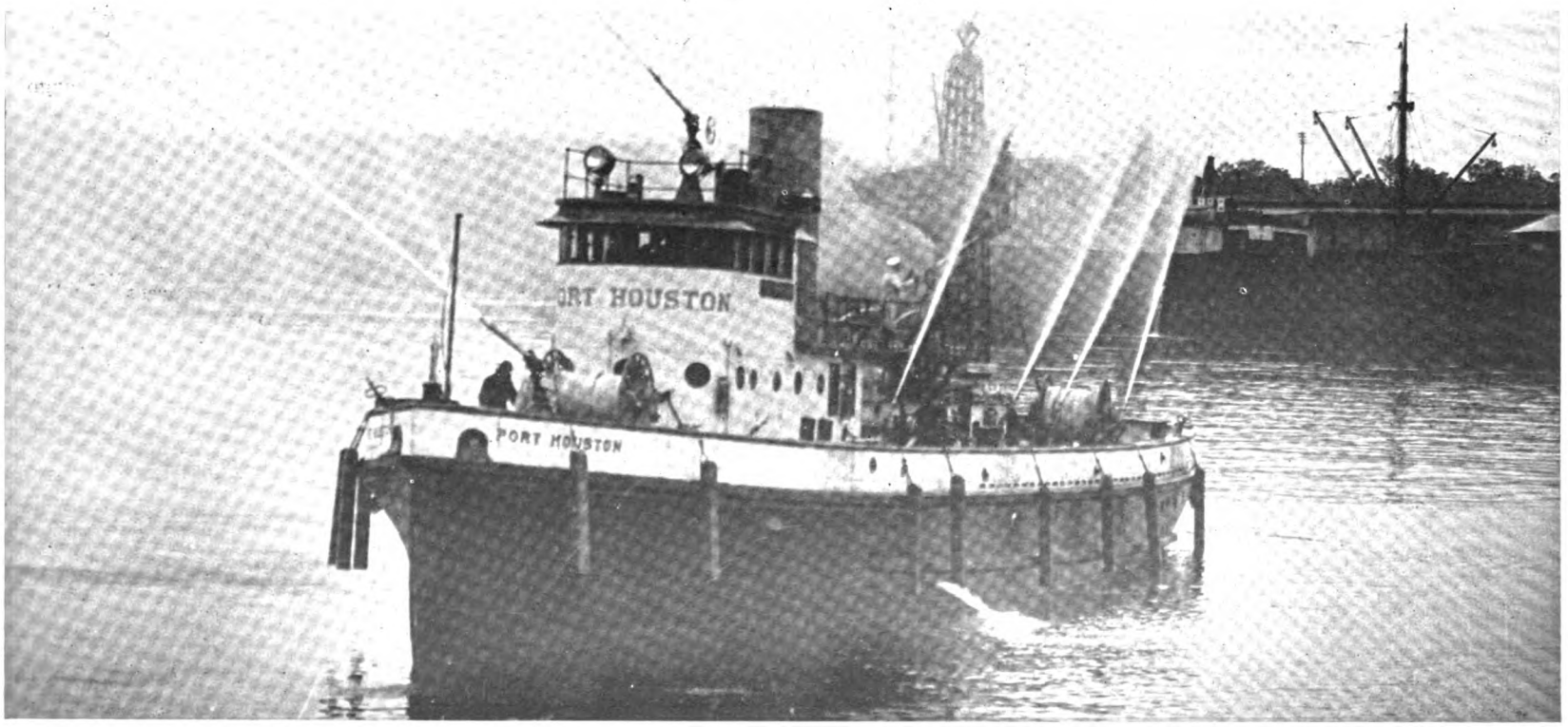
OPERATING costs of the Diesel electric fireboat PORT HOUSTON during the first year's operation amounted to only about $30,000, demonstrating the economy that was expected. Particularly in the item of fuel was a saving made, the amount charged for fuel-oil during the entire year amounting to less than $1500. Her fire fighting ability has been proved eminently satisfactory. She was able to cope with the situation perfectly at all fires she was called to, which chiefly were aboard vessels.

Owned by the Harris County Houston Ship Channel Navigation District, this fireboat was built and installed with Winton Diesel engines by the Bethlehem Shipbuilding Corporation in 1925 and delivered to the Port of Houston about the end of that year. She attracted much attention at the time she was completed, because she is the first electric fireboat with Diesel-engine generator sets. For her construction a sum of about $300,000 was available, which had to cover all expenses including delivery, the Houston Navigation and Canal Commissioners having no funds for the purpose beyond the proceeds of the bond issue for that amount authorized at an election in July, 1924.

The harbor proper of Houston is constituted by the water and frontage on, and adjacent to, the ship turning basin at the head of the deep water channel connecting with Galveston Bay, and is about 4 miles east of the city of Houston. The length of water front is nearly 10,000 ft., with fire hydrants located around the wharves and sheds and with sprinklers and hose connections in the sheds and warehouses, but until the advent of the electric fireboat there was no floating equipment for fire protection, although a few privately owned towboats were equipped with high pressure fire pumps.

Control of the port is vested in a board of harbor commissioners consisting of five men, two of whom are appointed by the county commissioners and two by the city commissioners, with a chairman appointed by the joint vote of the county and city commissioners. This board is technically known as the Harris County Houston Ship Channel Navigation Districts, and its secretary, B. C. Allin, is known as the Director of the Port. He is the executive officer. Administration by the board covers not only the harbor proper and the deep water channel to Galveston Bay, but extends over the entire length of the Houston Ship Channel through the Bay and, in so far as pilotage is concerned, to the Gulf of Mexico. Improvements are financed by bonds voted by the navigation district.

By the provision of the fireboat the port secured for the owners of water front property a flat reduction of 15 cents on the $100 valuation in the fire rate, the aggregate saving thereby effected representing a con-



Winton-Westinghouse Diesel-electric fireboat Port Houston demonstrates her fire fighting qualities

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The 1928 Merchant Marine Act

(*See page* 495)

Title I—Declaration of policy.

Sec. 1. The policy and the primary purpose declared in Section 1 of the Merchant Marine Act, 1920 (U. S. C., Title 46, Sec. 861) are hereby confirmed.

Title II—Shipping Board vessels.

Sec. 201. The United States Shipping Board shall not sell any vessel or any line of vessels except when in its judgment the building up and maintenance of an adequate merchant marine can be best served thereby, and then only upon the affirmative vote of five members of the board duly recorded.

Sec. 202. *In addition to its power to recondition and repair vessels under Sec. 12 of the Merchant Marine Act, 1920, as amended (U. S. C., Title 46, Sec. 871), the board may remodel and improve vessels owned by the United States and in its possession or under its control, so as to equip them adequately for competition in the foreign trade of the United States.* Any vessel so remodeled or improved shall be documented under the laws of the United States and shall remain documented under such laws for not less than five years from the date of the completion of the remodeling or improving and so long as there remains due the United States any money or interest on account of such vessel, and during such period it shall be operated only on voyages which are not exclusively coastwise.

Sec. 203. The necessity for the replacement of vessels owned by the United States and in the possession or under the control of the board *and the construction for the board of additional up-to-date cargo, combination cargo and passenger, or passenger ships, to give the United States an adequate merchant marine, is hereby recognized, and the board is authorized and directed to present to Congress from time to time, recommendations setting forth what new vessels are required for permanent operation under the United States flag in foreign trade, and the estimated cost thereof, to the end that Congress may, from time to time, make provision for replacements and additions.* All vessels built for the board shall be built in the United States, and they shall be planned with reference to their possible usefulness as auxiliaries to the naval and military services of the United States.

Terms and Conditions for Construction Loans

Title III—Construction Loan Fund.

Sec. 301(a). Sec. 11 of the Merchant Marine Act, 1920, as amended (U. S. C., Title 46, Sec. 870; 44 Statutes at Large, pt. 2, 1451), is amended to read as follows:

"Sec. 11(a). That the board may set aside, out of the revenues from sales, including proceeds of securities consisting of notes, letters of credit, or other evidences of debt, taken by it for deferred payments on purchase money from sales by the board, whether such securities are to the order of the United States, the United States Shipping Board, the United States Shipping Board Emergency Fleet Corporation, or the United States Shipping Board Merchant Fleet Corporation, either directly or by indorsement, until the amounts thus set aside from time to time aggregate $125,000,000. The amount thus set aside shall be known as the construction loan fund. The board may use such fund to the extent it thinks proper, upon such terms as the board may prescribe, in making loans to aid persons citizens of the United States in the construction by them in private shipyards or navy yards in the United States of vessels of the best and most efficient type for the establishment or maintenance of service on lines deemed desirable or necessary by the board, *provided such vessels shall be fitted and equipped with the most modern, the most efficient, and the most economical engines, machinery, and commercial appliances;* or in the outfitting and equipment by them in private shipyards or navy yards in the United States of vessels already built, *with engines, machinery, and commercial appliances of the type and kind mentioned; or in the reconditioning, remodeling, or improvement by them in private shipyards or navy yards in the United States of vessels already built.*

"(b) The term 'vessel' or 'vessels,' where used in this section, shall be construed to mean a vessel or vessels to aid in whose construction, equipment, reconditioning, remodeling, or improvement, a loan is made from the construction loan fund of the board. All such vessels shall be documented under the laws of the United States and shall remain documented under such laws for not less than 20 years from the date the loan is made, and so long as there remains due the United States any principal or interest on account of such loan.

"(c) No loan shall be made for a longer time than 20 years. If it is not to be repaid within two years from the date when the first advance on the loan is made by the board, the principal shall be payable in equal annual installments to be definitely prescribed in the instruments. The loan may be paid at any time, on 30 days' written notice to the board, with interest computed to date of payment.

"(d) All such loans shall bear interest at rates as follows, payable not less frequently than annually: During any period in which the vessel is operated exclusively in coastwise trade, or is inactive, the rate of interest shall be as fixed by the board, but not less than 5¼ per centum per annum. During any period in which the vessel is operated in foreign trade the rate shall be the lowest rate of yield (to the nearest one-eighth of 1 per centum) of any Government obligation bearing a date of issue subsequent to April 6, 1917 (except postal-savings bonds), and outstanding at the time the loan is made by the board, as certified by the Secretary of the Treasury to the board upon its request. The board may prescribe rules for determining the amount of interest payable under the provisions of this paragraph.

Loans Are Limited to Three-Fourths of Cost

"(e) No loan shall be for a greater sum than three-fourths the cost of the vessel or vessels to be constructed, or than three-fourths the cost of the reconditioning, remodeling, improving, or equipping hereinbefore authorized for a vessel already built.

"(f) The board shall require such security as it shall deem necessary to insure the completion of the construction, reconditioning, remodeling, improving, or equipping of the vessel within a reasonable time and the repayment of the loan with interest; when the construction, reconditioning, remodeling, improving, or equipping of the vessel is completed the security shall include a preferred mortgage on the vessel, complying with the provisions of the Ship Mortgage Act, 1920 (U. S. C., Title 46, Chap. 25), which mortgage shall contain appropriate covenants and provisions to insure the proper physical maintenance of the vessel, and its protection against liens for taxes, penalties, claims, or liabilities of any kind whatever, which might impair the security for the debt. It shall also contain any other covenants and provisions the board may prescribe, including a provision for the summary maturing of the entire debt, for causes to be enumerated in the mortgage.

"(g) The board shall also require and the security furnished shall provide that the owner of the vessel shall keep the same insured against loss or damage by fire, and against marine risks and disasters, and against any and all other insurable risks the board specifies, with such insurance companies, associations, or underwriters, and under such forms of policies, and to such an amount, as the board may prescribe or approve; such insurance shall be made payable to the board and—or to the parties, as interest may appear. The board is authorized to enter into any agreement that it deems wise in respect to the payment and for the guaranty of premiums of insurance."

(b) Sec. 11 of the Merchant Marine Act, 1920, as in force immediately prior to the enactment of this Act, shall remain in force in respect of all loans made before the enactment of this Act.

Sec. 302(a) There is authorized to be appropriated, to be credited to and for the purposes of the construction loan fund created by Sec. 11 of the Merchant Marine Act, 1920, as amended, such amounts as will, when added to the amounts credited to such fund by the United States Shipping Board under authority of law (exclusive of repayments on loans from the fund), make the aggregate of the amounts credited to such fund (exclusive of such repayments) equal to $250,000,000.

(b) When $250,000,000 has been credited to such fund (whether by the board under authority of law or from appropriations authorized by this section, but exclusive of repayments on loans from the fund) then no further sums (except such repayments) shall be credited by the board to such fund.

(c) The construction loan fund shall continue to be a revolving fund. Repayments on loans from the fund shall be credited to the fund, but interest on such loans shall be covered into the Treasury as miscellaneous receipts.

Authority Provided for Ocean Mail Contracts

Section 401. All mails of the United States carried on vessels between ports (exclusive of ports in the Dominion of Canada other than ports in Nova Scotia) between which it is lawful under the navigation laws for a vessel not documented under the laws of the United States to carry merchandise shall, if practicable, be carried on vessels in respect of which a contract is made under this title.

Sec. 402. As soon as practicable after the enactment of this act, and from time to time thereafter, it shall be the duty of the Postmaster General to certify to the United States Shipping Board what ocean mail routes, in his opinion, should be established and or operated for the carrying of mails of the United States between ports (exclusive of ports in the Dominion of Canada other than ports in Nova Scotia) between which it is lawful under the navigation laws for a vessel not documented under the laws of the United States to carry merchandise, distributed so as equitably to serve the Atlantic, Mexican Gulf, and Pacific coast ports, the volume of mail then moving over such routes and the estimated volume thereof during the next five years, the times deemed by him advisable for the departure of the vessels carrying such mails, and other requirements necessary to provide an adequate postal service between such ports.

Sec. 403. The Board shall, as soon as practicable after receipt of such certification from the Postmaster General, determine and certify to him the type, size, speed, and other characteristics of the vessels which should be employed on each such route, the frequency and regularity of their sailings, and all other facts which bear upon the capacity of the vessels to meet the requirements of the service stated by the Postmaster General. The Board in making its determination shall take into consideration the desirability of having the mail service performed by vessels constructed in accordance with the latest and most approved types, with modern improvements and appliances.

Sec. 404. The Postmaster General is authorized to enter into contracts with citizens of the United States whose bids are accepted, for the carrying of mails between ports (exclusive of ports in the Dominion of Canada other than ports in Nova Scotia) between which it is lawful under the navigation laws for a vessel not documented under the laws of the United States to carry merchandise. He shall include in such contracts such requirements and conditions as in his best judgment will insure the full and efficient performance thereof and the protection of the interests of the Government. Performance under any such contract shall begin not more than three years after the contract is let, and the term of the contract shall not exceed 10 years.

Specifications Given on Vessels for Service

Sec. 405. (a) The vessels employed in ocean mail service under a contract made under this title shall be steel vessels, shall be steam or motor vessels, and shall be either (1) American-built and registered under the laws of the United States during the entire time of such employment, or (2) registered under the laws of the United States not later than February 1, 1928, and so registered during the entire time of such employment or (3) actually ordered and under construction for the account of citizens of the United States prior to February 1, 1928, and registered under the laws

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of the United States during the entire time of such employment.

(b) A vessel for the services of which a contract is entered into under authority of this title, and the construction of which is hereafter begun shall be either (1) a vessel constructed, according to plans and specifications approved by the Secretary of the Navy, with particular reference to economical conversion into an auxiliary naval vessel, or (2) a vessel which will be otherwise useful to the United States in time of national emergency.

(c) From and after the enactment of this act, all licensed officers of vessels documented under the laws of the United States, as now required by law, shall be citizens of the United States; from and after the enactment of this act and for a period of four years, upon each departure from the United States of a vessel employed in ocean mail service under this title, one-half of the crew (crew including all employes of the ship other than officers) shall be citizens of the United States and, thereafter, two-thirds of the crew as above defined shall be citizens of the United States.

Sec. 406. Before making any contract for carrying ocean mails under this title the Postmaster General shall give public notice by advertisement once a week for three weeks in such daily newspapers as he shall select in each of the cities of Boston, New York, Philadelphia, Baltimore, New Orleans, Charleston, Norfolk, Savannah, Jacksonville, Galveston, Houston, and Mobile, calling for bids for carrying of such ocean mails; or when the proposed service is to be on the Pacific Ocean then in Los Angeles, San Francisco, Portland, Tacoma, and Seattle. Such notice shall describe the proposed route, the time when such contract will be made, the number of trips a year, the schedule required, the time when the service shall commence, the character of the vessels required, and all other information deemed by the Postmaster General to be necessary to inform prospective bidders as to the character of the service to be required.

Measure Provides Classification of Vessels

Sec. 407. Each contract for the carrying of ocean mails under this title shall be awarded to the lowest bidder who, in the judgment of the Postmaster General, possesses such qualifications as to insure proper performance of the mail service under the contract.

Sec. 408. (a) The vessels employed in ocean mail service under this title shall be divided into classes as follows:

Class 7. Vessels capable of maintaining a speed of 10 knots at sea in ordinary weather and of a gross registered tonnage of not less than 2,500 tons.

Class 6. Vessels capable of maintaining a speed of 10 knots at sea in ordinary weather, and of a gross registered tonnage of not less than 4,000 tons.

Class 5. Vessels capable of maintaining a speed of 13 knots at sea in ordinary weather, and of a gross registered tonnage of not less than 8,000 tons.

Class 4. Vessels capable of maintaining a speed of 16 knots at sea in ordinary weather, and of a gross registered tonnage of not less than 10,000 tons.

Class 3. Vessels capable of maintaining a speed of 18 knots at sea in ordinary weather, and of a gross registered tonnage of not less than 12,000 tons.

Class 2. Vessels capable of maintaining a speed of 20 knots at sea in ordinary weather, and of a gross registered tonnage of not less than 16,000 tons.

Class 1. Vessels capable of maintaining a speed of 24 knots at sea in ordinary weather, and of a gross registered tonnage of not less than 20,000 tons.

(b) The classification of a vessel may be based upon its speed without regard to its tonnage if the Postmaster General is of opinion that speed is especially important on the particular route on which the vessel is to be employed, and that a suitable vessel documented under the laws of the United States of a higher classification is not available on reasonable terms and conditions, or, on account of the character of the ports served or for other reasons, can not be safely or economically employed on such route.

Additional Compensation for Use of Planes by Lines

Sec. 409. (a) The rate of compensation to be paid under this title for ocean-mail service shall be fixed in the contract. Such rate shall not exceed: For vessels of class 7, $1.50 per nautical mile; for vessels of class 6, $2.50 per nautical mile; for vessels of class 5, $4 per nautical mile; for vessels of class 4, $6 per nautical mile; for vessels of class 3, $8 per nautical mile; for vessels of class 2, $10 per nautical mile; and for vessels of class 1, $12 per nautical mile. As used in this section the term "nautical mile" means 6,080 feet.

(b) When the Postmaster General is of the opinion that the interest of the postal service will be served thereby, he may, in the case of a vessel of class 1 capable of maintaining a speed in excess of 24 knots at sea in ordinary weather, contract for the payment of compensation in excess of the maximum compensation authorized in subsection (a), but the compensation per nautical mile authorized by this subsection shall not be greater than an amount which bears the same ratio to $12 as the speed which such vessel is capable of maintaining at sea in ordinary weather bears to 24 knots.

(c) If the Postmaster General is of opinion that to expedite and maintain satisfactory service under a contract made under this title, airplanes or airships are required to be used in conjunction with vessels, he may allow additional compensation, in amounts to be determined by him, on account of the use of such airplanes or airships. Such airplanes or airships shall be American-built and owned, officered, and manned by citizens of the United States.

(d) The Postmaster General shall determine the number of nautical miles by the shortest practicable route between the ports involved and payments under any contract made under this title shall be made for such number of miles on each outward voyage regardless of the actual mileage traveled.

Sec. 410. In the case of failure of a vessel from any cause to perform any regular voyage by a contract made under this title, a pro rata deduction shall be made from the contract price on account of such omitted voyage; and suitable deductions, to be determined by the Postmaster General, may be made from the compensation payable under the contract for delays, failures to properly safeguard the mails, or other irregularities in the performance of the contract. Deductions so determined upon shall be deducted by the Postmaster General from the payments otherwise due and payable under the terms of the contract. The Postmaster General may, in case of emergency, permit the substitution for a particular voyage of a vessel not within the provisions of the contract, even though not conforming to the requirements of Section 405.

Sec. 411. Any vessel operating under a contract made under this title may carry passengers and their baggage, and freight and express, and may do all ordinary business done by similar vessels.

Sec. 412. Naval officers of the United States on the active list may volunteer for service on any vessel employed in mail service under a contract made under the provisions of this title, and when accepted by the owner or master thereof may be assigned to such duty by the Secretary of the Navy. While in such employment such officers shall receive from the Government half pay, exclusive of allowances, and such other compensation from the owner or master as may be agreed upon by the parties; but such officers while in such employment shall be required to perform only such duties as appertain to the Merchant Marine.

Department Entitled to Transport Messengers

Sec. 413. Upon each vessel employed in ocean mail service under a contract made under this title, the Postmaster General shall be entitled to have transported such mail messengers as he may require, for whom shall be provided subsistence, suitable staterooms, and working quarters, all free of charge.

Sec. 414. (a) Section 24 of the Merchant Marine act, 1920 (U. S. C., title 46, section 880), is amended to read as follows:

"Sec. 24. That all mails of the United States shipped or carried on vessels shall, if practicable, be shipped or carried on American-built vessels documented under the laws of the United States. No contract hereafter made with the Postmaster General for carrying mails on vessels so built and documented shall be assigned or sublet, and no mails covered by such contract shall be carried on any vessel not so built and documented. No money shall be paid out of the Treasury of the United States on or in relation to any such contract for carrying mails on vessels so built and documented when such contract has been assigned or sublet or when mails covered by such contract are in violation of the terms thereof carried on any vessel not so built and documented. This section shall not be applicable in the case of contracts made under Title IV of the Merchant Marine Act, 1928."

(b) Section 7 of the Merchant Marine Act, 1920 (U. S. C., title 46, section 866), is amended by striking out so much thereof as reads as follows: "The Postmaster General is authorized, notwithstanding the act entitled 'An act to provide for ocean mail service between the United States and foreign ports, and to promote commerce,' approved March 3, 1891, to contract for the carrying of the mails over such lines at such price as may be agreed upon by the board and the Postmaster General."

(c) The act entitled "An act to provide for ocean mail service between the United States and foreign ports, and to promote commerce," approved March 3, 1891 (U. S. C., title 39, sections 657-665), is repealed.

(d) So much of the act entitled "An act making appropriations for the service of the Post Office Department for the fiscal year ending June 30, 1918, and for other purposes," approved March 3, 1917, as provides for contracts for the carrying of mails between the United States and Great Britain (U. S. C., title 39, section 666), is repealed.

(e) Subdivision (b) of section 4009 of the Revised Statutes, as amended (44 Statutes at Large, Pt. 2, 900), is amended to read as follows:

"(b) The provisions of subdivision (a) of this section shall not limit the compensation for transportation of mail which the Postmaster General may pay under contracts entered into in acordance with the provisions of section 4007 of the Revised Statutes (U. S. C., title 39, section 652), section 24 of the Merchant Marine act, 1920 (U. S. C., title 46, section 880), or Title IV of the Merchant Marine Act, 1928."

(f) Any contract made prior to the enactment of this act shall remain in force and effect in the same manner and to the same extent as though this act had not been enacted. Any such contract which expires on June 30, 1928, may be extended for a period of not more than one year from such date.

Ways for Providing Funds Outlined

Title V—Insurance Fund.

Section 501. Section 10 of the Merchant Marine Act, 1920 [U. S. C., title 46, section 869], is amended to read as follows:

"Section 10. That the Board may create out of insurance premiums, and revenue from operations and sales, and maintain and administer separate insurance funds which it may use to insure in whole or in part against all hazards commonly covered by insurance policies in such cases, any legal or equitable interest of the United States (1) in any vessel constructed or in process of construction; and (2) in any plants or property in the possession or under the authority of the Board. The United States shall be held to have such an interest in any vessel toward the construction, reconditioning, remodeling, improving, or equipping of which a loan has been made under the authority of this act, in any vessel upon which it holds a mortgage or lien of any character, or in any vessel which is obligated by contract with the owner to perform any service in behalf of the United States, to the extent of the Government's interest therein."

Title VI—Transportation of Government Officials.

Section 601. Any officer or employe of the United States traveling on official business overseas to foreign countries, or to any of the possessions of the United States, shall travel and transport his personal effects on ships registered under the laws of the United States when such ships are available, unless the necessity of his mission requires the use of a ship under a foreign flag: Provided, That the Comptroller General of the United States shall not credit any allowance for travel or shipping expenses incurred on a foreign ship in the absence of satisfactory proof of the necessity therefor.

Title VII—Miscellaneous.

Section 701. The appropriations necessary to carry out the provisions and accomplish the purposes of this act are hereby authorized.

Vessels May Be Used for National Defense

Section 702. (a) The following vessels may be taken and purchased or used by the United States for national defense or during any national emergency declared by proclamation of the President:

(1) Any vessel in respect of which, under a contract hereafter entered into, a loan is made from the construction loan fund created by section 11 of the Merchant Marine Act, 1920, as amended

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—at any time until the principal and interest of the loan has been paid; and

(2) Any vessel in respect of which an ocean mail contract is made under Title IV of this act—at any time during the period for which the contract is made.

(b) In such event the owner shall be paid the fair actual value of the vessel at the time of taking, or paid the fair compensation for her use based upon such fair actual value; but in neither case shall such fair actual value be enhanced by the causes necessitating the taking. In the case of a vessel taken and used, but not purchased, the vessel shall be restored to the owner in a condition at least as good as when taken, less reasonable wear and tear, or the owner shall be paid an amount for reconditioning sufficient to place the vessel in such condition. The owner shall not be paid for any consequential damages arising from such taking and purchase or use.

(c) The President shall ascertain the fair compensation for such taking and purchase or use and shall certify to Congress the amount so found by him to be due, for appropriation and payment to the person entitled thereto. If the amount found by the President to be due is unsatisfactory to the person entitled thereto, such person shall be entitled to sue the United States for the amount of such fair compensation and such suit shall be brought in the manner provided by paragraph 20 of section 24 or by section 145 of the Judicial Code, as amended [U. S. C., title 28, sections 41, 250].

Section 703. (a) When used in this act, and for the purposes of this act only, the words "foreign trade" mean trade between the United States, its Territories or possessions, or the District of Columbia and a foreign country; Provided, however, That the loading or the unloading of cargo, mail, or passengers at any port in any territory or possession of the United States shall be construed to be foreign trade if the stop at such territory or possession is an intermediate stop on what would otherwise be a voyage in foreign trade.

(b) When used in this act the term "citizen of the United States" includes a corporation, partnership, or association only if it is a citizen of the United States within the meaning of section 2 of the shipping act, 1916, as amended [U. S. C., title 46, section 802].

Section 704. The policy and the primary purpose declared in section 7 of the Merchant Marine Act, 1920 [U. S. C., title 46, section 866], are hereby reaffirmed.

Section 705. In the allocations of the operations of the ships, the Shipping Board shall distribute them as far as possible and without detriment to the service among the various ports of the country.

Section 706. This act may be cited as the "Merchant Marine Act, 1928."

Finis

Diesel Ferry Tests Sound Compass

By H. H. Dunn

TO the Diesel electric-driven ferryboat, YERBA BUENA, on San Francisco Bay, fell the honor of being the first ship to conduct experiments with an entirely new sound compass, just invented by Frank Rieber, electrical and marine engineer of this California port. Through fog so thick that the look-out on the bow could not see the after pilot house, the ferry, carrying 800 passengers, crept across the bay. In the forward pilot-house, the captain at the wheel, with the first and second officers on either side of him, watched two small, square-topped black boxes, while the third officer played a searchlight against the wall of fog, and sounded the siren at fixed intervals.

A brilliant red light glowed for an instant on the revolving disk on top of one of the boxes. In a fraction of a second, a similar light flashed on the other box. An indicator needle, spinning between the two, stopped at a point marked "700 feet." The red lights flashed again, both seemingly in the same direction. At the first flash, on the port bow, the captain spun his wheel to starboard, and, through his pilot-house controls to the engine-room, sent the ferry full-speed ahead.

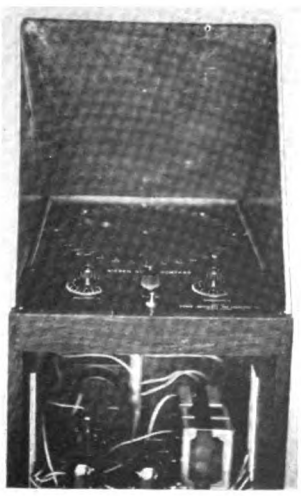
Hardly had the YERBA BUENA changed her course, when, so close that a pebble could have been tossed on board, an express liner in off the Pacific glided by. Had the ferry continued her course, she could hardly have avoided a collision with the steamer. The newest life-preserver of the sea—the sound compass—had given warming of her approach.

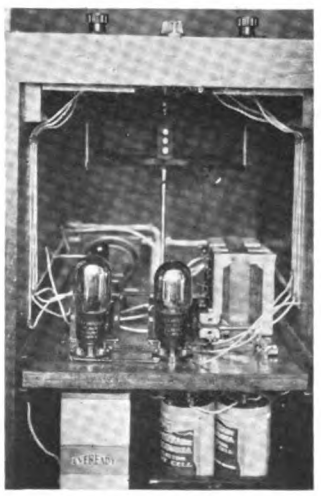
Running automatically, constantly and correctly telling the direction and distance of sounds and signals, this device is being given continued tests on several of the 41 ferryboats which, day and night, weave their way across San Francisco Bay. Simply stated, the sound compass consists of two sections, the first a revolving sound-receiver, or collector, placed on top of the pilot house, or on an open space on the deck, where the sound waves will be unobstructed in reaching it, and the small, compass-like, indicators inside the pilot-house. The two devices are kept at the same rate of rotation by synchronized motors, and the speed is slow, so as to catch definitely the direction of all noises, of the lowest pitch as well as the highest.

Sound collected by the revolving shield, or reflector, is turned by the concave and polished sides of the half-globe against a solid paraboloid of metal in the center, whence it passes through an opening in the rear of the shield to a microphone. Through this instrument, the sound is amplified and carried by wire to the indicators inside. Improvements are now being made involving radio transmission which will eliminate the wires. The top of the indicator consists of a flat surface, in the center of which revolves a disk about 15 inches in diameter. The immovable rim around this disk is marked off in directions and degrees, exactly the same as the rim of a compass.

On, or near, the perimeter of the revolving disk, is set a small neon-gas lamp, which will glow invariably when excited by an electric current. As the receiver picks up the sound of whistle, siren or bell, the light flashes brilliantly, in the same direction as the source of the sound. To obtain the distance of the source of the sound, two indicators and two receivers are installed, the former, side by side in the pilot house; the latter at opposite ends of the vessel. A needle, connected with both indicators, its movement based on the difference of time between the flashes on the two disks, plays over a metal arch, marked off in foot distances. This translates immediately the time between the signals, as received at bow and stern of the ship, into distance of the source of the sound from that ship, and gives the answer in a split second.

Providing the oncoming vessel is sounding its signal by whistle, siren or bell; or the buoy, beacon, light-house, or other marker is making an audible signal, the master of the ship equipped with this sound compass has been able to tell, in actual, fog-covered experiments, the direction and location of the source of the sound, within a range of two degrees for the former and twenty feet for the latter. The device is intended primarily to reduce the risk of collision in crowded traffic lanes on bays, rivers or lakes, but is also valuable for ships at sea in giving direction and distance of fixed signals on shore. As so far tried in some fifty tests on San Francisco Bay, it has been accurate and effective.





Left: Indicator board of sound compass showing rotating disc and flash lamps. Center: Receiving instrument on pilot house roof. Right: Sound amplifier and disc actuating mechanism

Shipyard Reorganized

An important motorship order was arranged on May 8 when Alfred Holt & Co., Ltd., Liverpool, placed a contract with the re-organized firm of Workman, Clark (1928), Ltd., for the building of a passenger-cargo motorship of 15,000 tons deadweight. The vessel will be 470 ft. long by 50 ft. beam with Danish built twin-screw Burmeister & Wain Diesel engines.

Henry J. Steinbreder, president of the Fulton Iron Works Co., St. Louis, has announced that his company has purchased the Foos Engine Company's plant and business, and that the Springfield plant will be operated as a branch.

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Magnetic Clutches for Marine Applications

A Comprehensive Outline of Marine Installations Embodying Features of Automatic Protection to Machinery

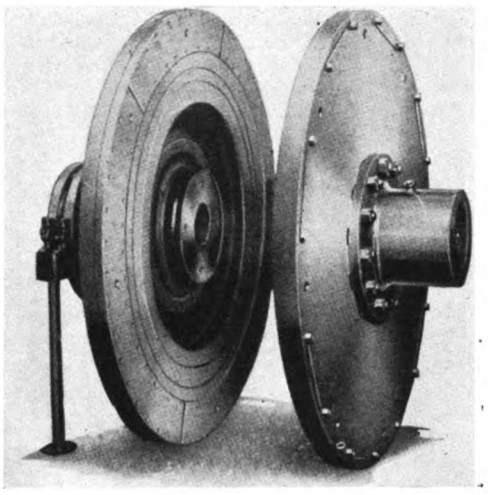
By W. Hetherington, Jr.

DESIRABLE objectives on shipboard are the reduction of weight, economy in space and savings in cost of auxiliary machinery. To accomplish these ends without decrease in operating efficiency are steps towards economies in ship operation and, therefore, have a definite appeal to marine engineers.

The development of the Diesel engine for marine service, with its attendant auxiliary equipment, also presents the thought that it is quite desirable to operate auxiliary units—such as the air compressor and pumps—without the necessity of providing separate unit drives. Almost all Diesel-operated ships use motor-driven electrical auxiliaries. Electric current supply is, therefore, made available for their operation. The elimination of separately driven auxiliary units obviously necessitates some form of connecting the prime mover with the driven load. It is, therefore, natural to consider a form of clutch for this purpose.

Obviously any device employed to connect and disconnect auxiliary machinery on shipboard from its source of power must be simple in operation, rugged in design, and able to withstand normal wear and tear. The device should be easy in operation, have low maintenance cost, fixed capacity and no undue thrust upon the apparatus it controls. Such a device is a magnetic clutch which adequately fulfills these requirements and in addition provides direct magnetic action, insures smooth acceleration, is extremely simple in design and operation, and utilizes only a fraction of the electric current supply available for its operation. It consists of two members in one of which is placed a magnetic winding. When the current passes through this winding the clutch becomes engaged and when the circuit is opened the clutch becomes disengaged.

The two parts are known as a field member and an armature member. The former contains the magnetic winding previously referred to and the latter is supported by a spring plate, which eliminates the friction and wear of a keyed shaft. The magnetic winding within the field member is so located that its direct magnetic pull. when the coil is energized, produces pressure between the friction surfaces. This direct action results in a very simple compact structure without toggle joints, pivoted arms or sliding collars.



Armature and field members separated, showing friction lining

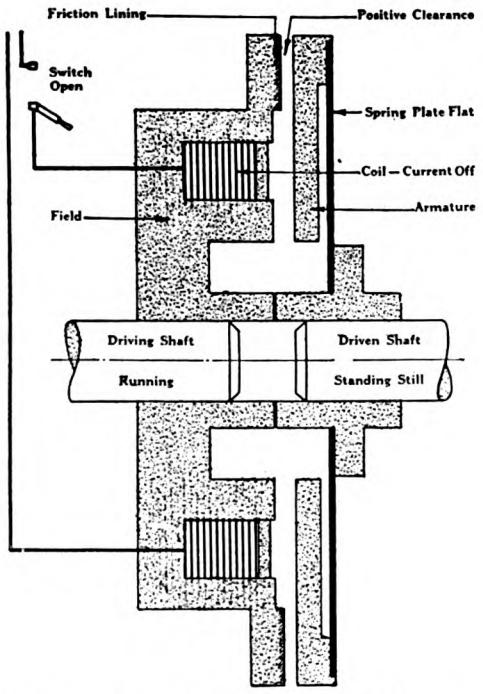
Disengagement of the two clutch members when the circuit is opened is hastened by the action of the spring plate of the armature member. When disengaged the two sections of the clutch stand a short distance apart with a positive running clearance. Where the two members engage at the periphery of the clutch a friction lining is placed on one member. This lining may be easily and quickly renewed as occasion warrants, depending upon the duty of the particular clutch application. Current is fed to the magnet coil by means of two collector rings energized by a circuit feeder supplying current through carbon brushes which rest upon them. For marine use all parts of the clutch members including the collector rings are non-corrodible, which prevent possible corrosion due to salt atmosphere.

Operation is controlled through a knife switch in the case of small sizes of clutches and by means of a manual or push-button actuated contactor type controller in larger sizes. When the circuit is closed and the current passes through the field winding, the magnetic pull does not attain its full value immediately. There is an appreciable time interval before the maximum pull becomes effective. Because of this feature, smooth acceleration results.

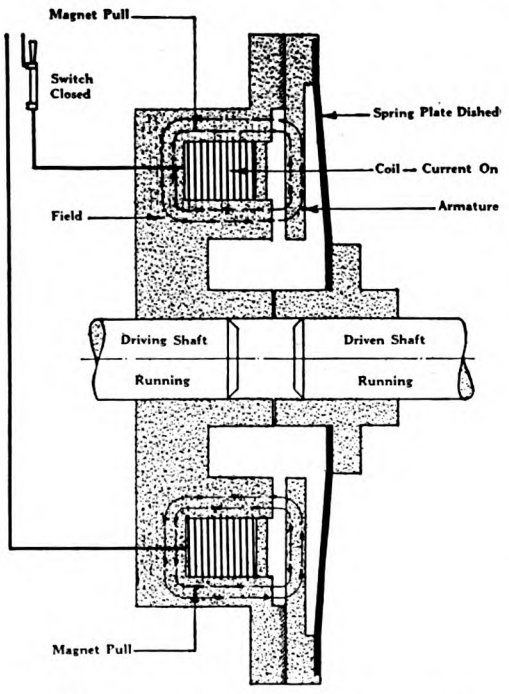
Since the friction surfaces engage gradually, the load is picked up smoothly, which is entirely automatic and independent of the operator. The actual time of engagement is fixed for a given size clutch and varies from a fraction of a second in the case of small ones to several seconds for large clutches. There is no end thrust on the shafts as the magnetic pull balances the pressures between the friction surfaces. Centrifugal force has no effect on the force exerted between the two members. Consequently they may be operated at high peripheral speeds. Tests for dynamic and static balance are always made.

A given size electro clutch exerts a definite number of pounds pull which creates a given pressure between the friction surfaces. Therefore the horsepower which the clutch will transmit at any particular speed, with proper gap adjustment, is a fixed quantity. The torque does not appreciably exceed its rating, thus in starting sudden unexpected shocks are avoided. Auxiliary application on shipboard, to transmit up to a maximum of about 2100 hp. at 100 r.p.m., is practicable.

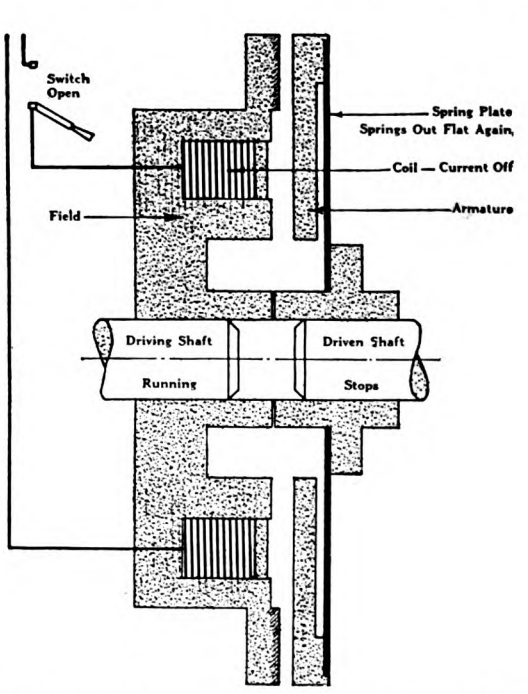
The torque capacity is known and cannot be exceeded by adjustments. It is interesting to note that the current required by an average size magnetic clutch used on 230-volts, d. c.



Clutch de-energized, driving shaft running, driven-shaft standing still



Clutch energized, both shafts running



Clutch is de-energized again, driven shaft stops but driving shaft continues to run

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normal voltage supply is 2.6 amperes. Therefore the operating cost is extremely low. There is nothing to get out of order or wear out except the friction lining which is easily adjusted, and replaced by removing some cap screws withdrawing the worn sections and fitting new lining. This can be done as readily as the friction lining may be renewed on automobile brake bands.

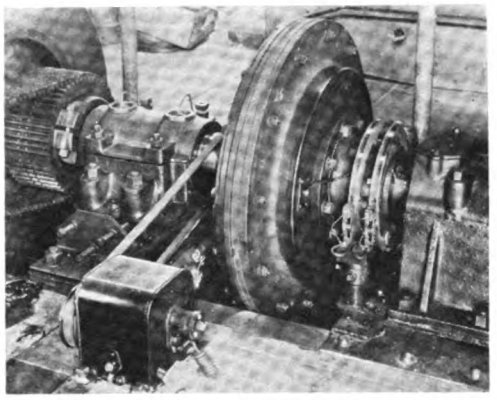
For normal applications, magnetic clutches are designed with a fixed lining area. However, where an appreciable slip is a service requirement or where they are very frequently started and stopped and the rate or wear is desired to be reduced to a minimum (also in high inertia loads which require a comparatively long period of acceleration), they may be designed with greater lining area to meet such operating conditions. For service where a common bedplate is not used between the driving and driven members and where there may be a possibility of slight misalignment due to wear of bearings, it is recommended that they be provided with "centering bearings" which are self-aligning roller bearings. This design is to be particularly recommended where slight misalignment may occur on shipboard and where automatic magnetic control is used for operation of the clutch.

During the past year or two many interesting marine installations have been made which are typical of the uses to which magnetic clutches may be put. One of the most frequent applications is that of the Diesel driven combined generator and air compressor where the air compressor is connected to the outboard shaft extension of the generator armature. A picture of such an installation is shown herewith. It illustrates a Nelseco four-cycle, 150 hp. airless injection Diesel engine with a rated speed of 260 r.p.m., connected to a 50 kw. 250 volt d. c. generator which is in turn connected by means of a 32 in. clutch to an air compressor having a capacity of 150 cu. ft. of free air per minute, compressed to 1000 pounds. This compressor is of the 3-stage type requiring about 65 b.hp. The magnetic clutch is unusually large and rugged as no unloading device is used when starting up the air compressor.

Quite a number of merchant ships have installations of this kind, some of which have been in satisfactory operation for a number of years. Among these may be mentioned the motorships STEELMOTOR, STEELVENDOR, STEEL ELECTRICIAN and E. T. BEDFORD.

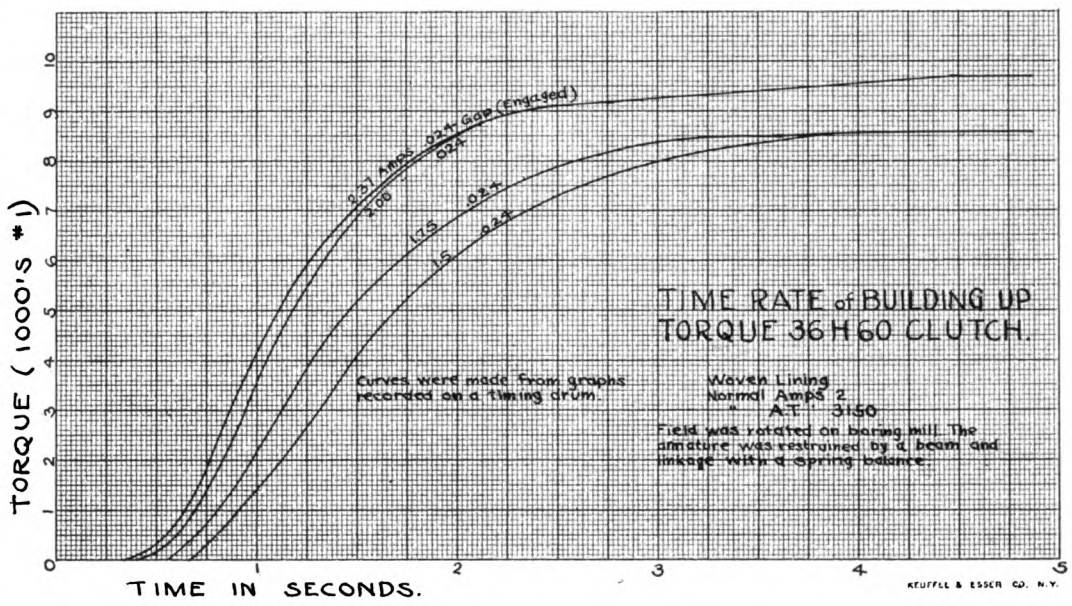
The United States Shipping Board under its present conversion program has approved the use of a number of magnetic clutches for air compressor drive similar to the example mentioned. These installations will be made in the near future. The clutches will be 44 in. and will operate with Nordberg Diesel engines, of the three-cylinder, two-cycle type; cylinder diameter of 16¾ in., stroke 22 in. and rated speed 225 r.p.m. The engines will drive 340 kw., 240 volt generators, each to be connected through a magnetic clutch to maneuvering and emergency compressor.

Magnetic clutches may be used advantageously as a means of protection to the prime mover in case of an overload or "jammed" condition imposed upon the driven unit. Where steam was the motive power, in the event of an overload, the engine simply "stalled." Utilizing Diesel engines for prime movers presents a different problem. It is quite necessary to protect them under abnormal operating conditions.



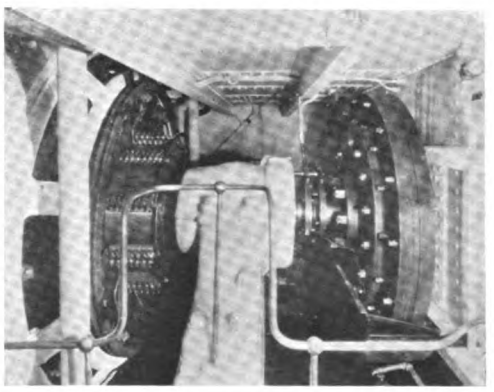
Magnetic clutch on Diesel driven pump of dredge Henry J. Leek

A very interesting application of the protective feature is that of a Diesel-driven pump unit on the dredge HENRY J. LEEK which operates in Great South Bay, N. Y., utilizing a 36 in. magnetic clutch connected between the Diesel engine and the centrifugal pump which it operates. Coupled to the drive shaft by means of a belt is a centrifugal governor, the functions of which is to open and close a circuit to the clutch coil. In the event of a slow-down in speed or stoppage of the pump due to an obstruction entering it, the governor will automatically open the circuit to the clutch coil, causing it to disengage and prevent injury to the machinery. The control scheme was so worked out that automatic acceleration from a push-button control station was provided. A torque setting rheostat was also included. To provide an indication to the operator on deck that the clutch was engaged a lamp, within the watertight push-button control station, was illuminated behind a bull's-eye. The contacts on the centrifugal governor were so arranged that a 10 per cent reduction in speed would automatically disengage the clutch.


TORQUE (1000's #)
TIME IN SECONDS.
TIME RATE of BUILDING UP TORQUE 36 H 60 CLUTCH.
Curves were made from graphs recorded on a timing drum.
Woven Lining
Normal Amps 2
A.T. 3150
Field was rotated on boring mill. The armature was restrained by a beam and linkage with a spring balance.
KEUFFEL & ESSER CO. N.Y.

With the use of Diesel engine drive for cutter-head drives on dredges, it is desirable to protect the Diesel from injury in case the cutter-head stalls. While it would be satisfactory to employ a centrifugal governor device to disconnect the cutter-head from the engine as in the case of the pump drive mentioned, another satisfactory method of protection would be to insert a rheostat in the clutch coil circuit so that the torque of the clutch can be regulated. In the event of "jamming" the cutter-head, the clutch would slip and prevent excessive load on the prime mover. In starting up the equipment initially, a scheme may be employed to by-pass the rheostat until the driven member and cutter are brought up to a full speed, after which the rheostat is inserted serving to regulate the energizing current of the clutch so that the load at which it will slip can be carried to suit different conditions. Such applications require clutches with greater lining area than is normally provided.

An example of propeller drive is that employed on U. S. Coast Guard Diesel-electric cutter NORTHLAND, in which the clutch is mounted on the propeller shaft. It is installed as a means of protection to the propeller and to prevent breakage when the vessel is operating in Arctic ice fields. At such time the clutch is electrically engaged and at others it acts as a solid coupling, the two members being bolted together by means of through bolts. A 66 in. magnetic clutch having an extra amount of lining area is used to transmit 1000 brake horsepower at 125 r.p.m. When electrically operated the clutch is so set that it will slip if the torque of the propeller shaft exceeds a given amount. When mechanically operated, that is as a bolted coupling, the electrical circuit is opened and the friction ring is backed off by means of suitable adjusting plugs until the armature member of the clutch can be bolted against the field member by means of coupling bolts provided for this purpose. The clutch then forms a solid mechanical coupling. The holes for the bolts are so arranged that they will register in only one relative position of the two members. This insures always bolting together in the same relation.



Magnetic clutch for protecting propeller drive on Diesel-electric cutter Northland

When it is desired to operate magnetically the driving bolts are removed and the friction ring is advanced by the adjusting plugs to the proper position, the controller opens and closes the clutch coil circuit and limits the torque, disengagement occurs if the propeller "jams" due to ice obstruction.

These examples of marine clutch application are typical of the many possible uses on shipboard. Wherever it is desired to change from one form of control to another, the magnetic clutch is frequently adaptable. Further consideration of advantages to be effected, by its use on shipboard may ultimately result in a much wider application for auxiliary machinery on merchant vessels.

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Another American Double-Acting Diesel

Highly Satisfactory Results Obtained in Tests of the Sun Double-Acting Engine

By J. Barraja-Frauenfelder*

Part II (Continued from the May Issue)

IN the first instalment of this description of the Sun double-acting Diesel engine the general characteristics were discussed, as well as the reason for its development. More detailed particulars of the features of the design will now be given. The transverse horizontal section on page 520 shows the circumferential arrangement of scavenging ports in the cylinder and their co-relation with radial passages through the cylinder belt. Each of these passages is provided with a control element, the function of which is to check communication between the scavenge air receiver space and the interior of the cylinder during the short interval after the piston first uncovers the scavenging ports. It operates until pressure release has taken place through the exhaust ports. Sectional views of such a control element are given in the drawing of the scavenge valve assembly. It comprises four flat, narrow strips, two of ordinary spring steel, joined into one at their pivotal end and stamped out of one piece, lightly held against the flat face of cage (1) by retainer (3). These steel strip valves open inwardly, their lift being limited by a retainer (3). They permit flow only into the cylinder as soon as the pressure in the latter drops below that of the scavenging air in the surrounding receiver space and return to their seats at the least tendency of the flow to reverse.

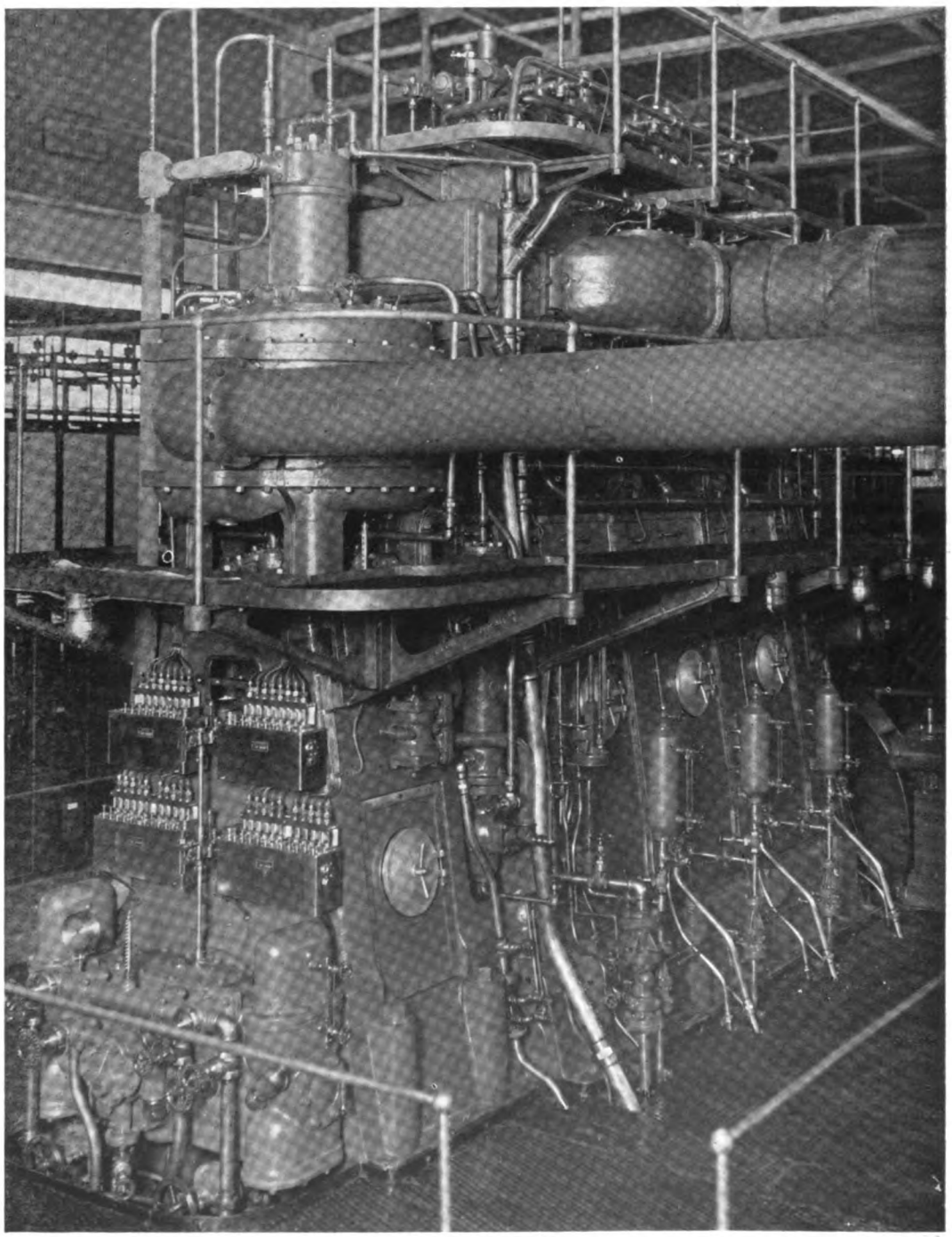
From this it will be observed that the action of these valves is entirely automatic. Owing to the narrowness of the passages which they control with the resulting shortness of unsupported span, the load conditions to which these check valves are exposed can easily be met with very thin steel strips which as a consequence become extremely light in weight. Their response to the slightest pressure difference is practically instantaneous, and positive action is assured by the small lift required, to uncover the full passage area.

In their construction these valves are practically identical with what in modern air compressor practice are known as "feather valves," which also consist of long, flat, steel strips controlling air passages in the form of narrow slots. Similarly their action closely corresponds to that of the "feather valves" except that the latter are usually exposed to higher pressures and also less favorable temperature conditions than in the present application. This applies particularly to air compressor discharge valves which not only have to stand the full delivery pressure, but are exposed to the high temperature of compressed air flowing past them when being discharged from the cylinder. When used as check valves on scavenging ports a stream of cool air only flows past these valves. Even during the short interval preceding pressure release through the exhaust ports their location at the end of what is at that moment a deep, dead pocket, together with the protection afforded by the retainer, prevents them from coming into direct contact with the hot gases of combustion.

It is therefore apparent that it would be difficult to improve the simplicity of this scavenging port control arrangement from the manufacturing point of view. The facility for delivering scavenging air to any point around the circumference of the cylinder by virtue of the latter being surrounded by liberal receiver space makes it possible to give the scavenging ports the form of short radial passages through the side walls of the cylinder. These passages being all alike in section and radial length, and uniformly spaced circumferentially, the cylinder castings become greatly simplified and considerably easier to make than is the case on some recent two-cycle engine cylinder constructions. The only parts that could possibly require occasional replacement are the valves themselves.

These valves are easily accessible through large openings in the side of the cylinder beam, only light sheet metal or aluminum covers being used to close off the latter. Owing to the provision of individual control valves in front of each port, any one of the latter can be closed off entirely if desired without affecting delivery of a full stream of scavenging air through the other ports.

Lest it be thought that the constructive and mechanical advantages just described have been the only incentive for their adoption, a study of the diagrams A, B, C and D is invited. The cylinder cross sections at the left indicate the particular system of port scav-



Exhaust side of engine, showing Manzel force feed lubricators at forward end

*Consulting Diesel Engineer.

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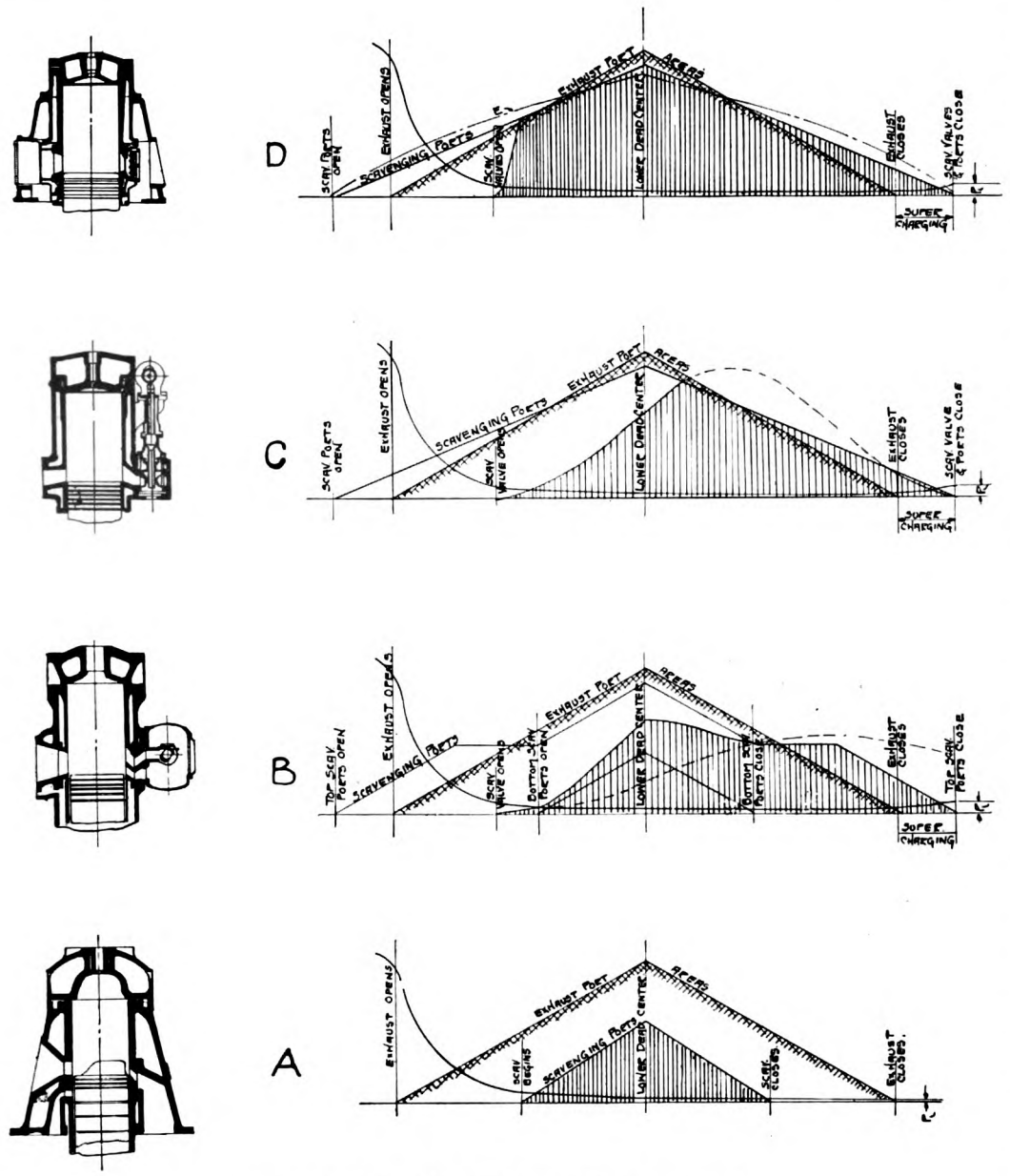


Diagrams illustrating cycle of cylinder scavenging

enging that is to be discussed, and the curves on the right show the inlet and exhaust areas made available in each. In all the diagrams abscissae represent piston travel and ordinates are proportional to areas. The curved lines beginning near the upper left hand corner of the diagram is the end or "toe" of a two-cycle indicator card and is the only line which measures pressures. In all cases the double cross-hatched areas represent exhaust port openings and the spaces filled in with vertical line shading show the net maximum areas available for the passage of scavenging air. Although the curves are approximate, they have been drawn as nearly as possible to the same scale and form a convenient basis for the comparative study of the various types of port scavenging which they portray.

Diagram A shows the most elementary type of port scavenging in which inlet ports lower than the exhaust ports are used. The short scavenging period and small scavenging port area make it necessary to resort to high scavenging air pressures, in order to attain anything like the requisite velocities. High air velocities are objectionable on account of too turbulent scavenging and because they make necessary a large excess volume of air to make up for the resulting appreciable loss through the exhaust ports. All this calls for a large scavenging pump and excessive negative work. A further loss of air results from the early closing of the scavenging ports, permitting the air pressure in the cylinder to drop until the piston covers the exhaust ports, when compression begins with the low initial pressure (P). These phenomena account for the fact that engines of this type have an output of 20 to 25 per cent lower than more modern types of two-cycle engines and also are less efficient.

Diagram B shows a much more favorable method of port scavenging in which a row of valve controlled scavenging ports is superimposed over the single row just described, placing the top edge of this second row higher than that of the exhaust ports. It permits of a detailed following out of the various phases of this scavenging cycle. Uncovering the upper row of ports has no effect at first because at that time they are still obstructed by the rotary valve which controls their opening; until pressure release through the exhaust ports has taken place, the wearing surfaces of this valve are therefore subjected to the momentary cylinder pressure.

The next event is the creeping commencement of opening of the rotary valve, which begins to yield a substantial total opening only when the area of the bottom ports shows its effect. Owing to the danger of a blow-back into the scavenging receiver, the opening of the rotary valve must be retarded to a point which will give a margin of safety at any load and an availability of area corresponding to this margin must be sacrificed.

After the re-covering of the lower scavenging ports air continues to enter the cylinder through the upper ports until these also are re-covered by the piston, i. e., beyond the point of re-covering the exhaust ports, this being known as the period of super-charging. The area of the rotary valve opening is maintained at a substantial excess over that of the auxiliary (upper) ports until well after the supercharging period has ended.

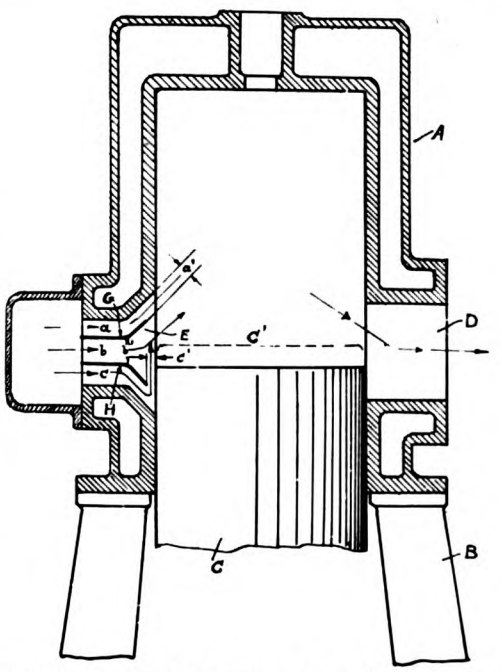
The irregularity of the total net area in the neighborhood of the dead center is due to its summation of the straight port opening line and the curve of valve areas. Attention is called to the super-charging pressure (P) which is notably higher than that shown in diagram (A), in spite of the fact that a considerably lower scavenging air pressure can be used because the total port area is so much larger. It is to be noted, however, that the center of gravity of the area covered with vertical line shading is considerably to the right of the dead center, the interpretation of which is that a substantial part of the scavenging area is made available at a period when the piston is accelerating and when the time for utilizing the area is becoming short.

In view of what has been said, diagram (C) is largely self-explanatory. Attention is called to the abruptness of the valve lift curve and to the location of the center of gravity of the vertical line shading closer to the dead center than was the case with diagram (B).

A serious disadvantage of this particular method of port scavenging is the size of the single valve required to control the entire port area and scavenging air supply. The valve lift becomes of necessity quite high and the cam must be made very steep in order to obtain as large a valve lift area as is desirable near the dead center. Considering the very appreciable weight of such a valve, the resulting kinematic forces become excessive and even where two valves are used, as has been done, these forces have proved to be too great for continuous satisfactory operation.

Diagram (D) shows scavenging area development in an engine having port scavenging controlled by automatic plate valves. Almost instantaneous development of the maximum possible scavenging area, its long duration over a period of slowest motion on the part of the piston and effective super-charging stand out so prominently that comment is unnecessary.

The considerably larger useful scavenging area obtainable here than with the same size ports under either of the methods illustrated at (C) or (B) make it possible to employ lower scavenging air velocities. The necessary air pressure, and therefore the negative work, become less and the exhaust gases can be expelled at a minimum expenditure of energy.



Cylinder scavening system described in text

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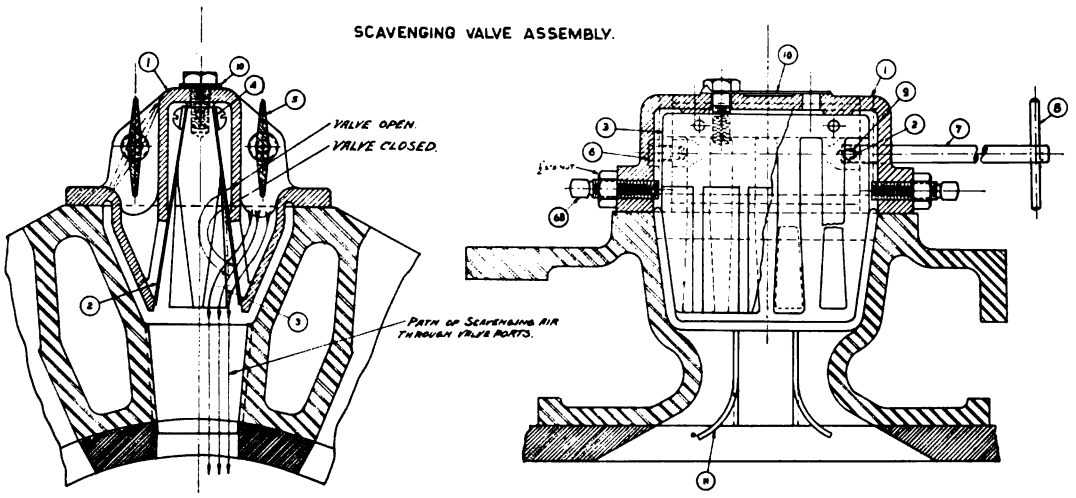
The dot and dash curve shows the area development that can be produced by suitably shaping the contour of the scavenging ports so as to further a still more effective supercharge.

Another cross section sketch illustrates the method used to further improve the flow of air into the cylinder by means of guide vanes as indicated. The scavenging port is divided into three passages (a), (b) and (c) by means of guide vanes (G) and (H), which conform respectively to the contour of the upper and lower walls of the port and terminate at a distance, preferably less than the width of the passages between the vanes and the walls of the port, from the cylinder bore.



Illustrating guide vanes used to improve flow of air into the cylinder. *See page* 518

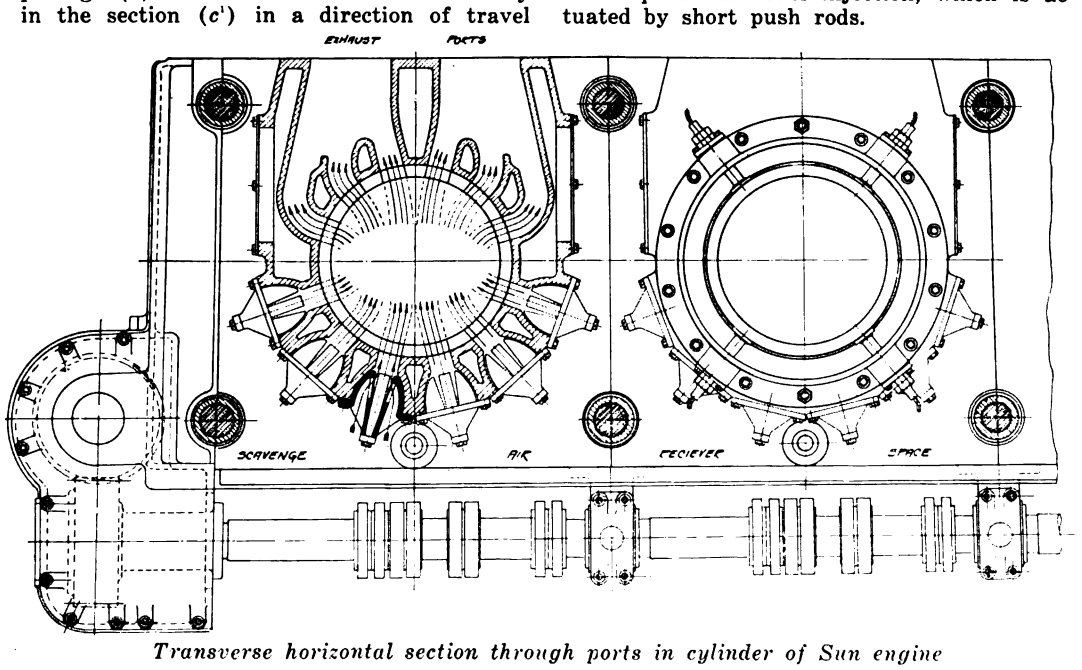
By virtue of the provision of these guide vanes in the scavenging port, it will be noted that the scavenging air from the receiver will pass through the scavenging port and toward the cylinder in three separate streams, each of the streams having a definite direction. Further, it is to be noted that since the pressure drop in the scavenging port is comparatively small, each of the air streams attain its maximum velocity at the narrowest section of the passages through which the streams respectively pass.

Thus, the air stream passing through the passage (*a*) attains its maximum velocity in the section (a^1) and enters the cylinder in a line parallel to the contour of the upper wall of the port or at an acute angle to the axis of the cylinder toward the top thereof. The air stream passing through passage (*b*) attains its maximum velocity in the section (b^1), in which section its flow is in a line normal to the cylinder axis and with the piston in lower dead center position would tend to pass straight across the cylinder bore and into the exhaust. With the piston in any position above lower dead center and not closing the scavenging port, for example, as indicated by dotted line (C^1), this stream would be caused to deviate in an upward direction by the wall of the piston.

The air stream passing through the upper passage (*c*) will attain its maximum velocity in the section (c^1) in a direction of travel parallel to and alongside of piston (*C*), which causes it to impinge within the confines of the port on the air stream from passage (*b*) at an angle of ninety degrees. Since the vanes (G) and (H) in the following contour of the upper and lower port walls form a divergent orifice in the plane where the air stream from lower passage (*c*) impinges upon the stream from middle passage (*b*) the direction of the stream from passage (*b*) is readily influenced by the stream from passage (*c*), with the result that the united streams flow into the cylinder in a direction toward the top thereof, more or less parallel to the stream from upper passage (*a*). The upward deflection of the stream from passages (*b*) and (*c*) will be increased in the higher positions of the piston to such an extent that in the higher positions of the piston, leaving the port open the combined streams from passages (*b*) and (*c*) will cause the stream from passage (*a*) to be deflected and travel with a steeper inclination toward the cylinder top.

A scavenging port structure is thus provided which will insure the delivery of the scavenging air to the cylinder in a direction toward the top of the cylinder, thus insuring substantially complete circulation of the scavenging air throughout the cylinder with resultant increase in efficiency of the scavenging.

Automatic port control satisfies all essential requirements to an extent far beyond accomplishment with mechanical port control. A most beneficial advantage resulting from the use of automatic port control valves is the simplicity of the engine valve gear; the only remaining mechanically operated valve is the one required for fuel injection, which is actuated by short push rods.



Transverse horizontal section through ports in cylinder of Sun engine

The various assembly drawings and illustrations of the structural details reveal the principal members of the engine (especially the framing), of such design as to make them easily adapted to standardization.

A feature worthy of special notice is the transmission of the longitudinal working loads through the outer cylinder wall directly to the cylinder bolts, without causing the belt section containing the ports to participate in any load transmission. The latter is at all times under compression, a feature especially pronounced on the exhaust-port side; the advantages of this will be appreciated, if it is remembered that cylinder trouble on many early two-cycle engines could be directly traced to the absence of such provisions. Surrounding this belt section with the ports, we have the scavenging air receiver, built up of easily removable steel plates and running the entire length of the cylinder assembly.

Owing to the use of the port scavenging control already described, the high pressure ends of the cylinder castings have been stripped of the multitude of valve pockets and irregular passages which so enormously complicated double-acting engines, both two-cycle and four-cycle, as heretofore built. The elimination of valve operating gear with the inevitable cumbersome linkage and mechanism indispensable for actuating valves in different planes and different centerlines simplifies the construction so much that the double acting feature is at first hardly recognized.

These results have been accomplished without introducing a single element which has not been tried and proven by well matured experiences gained from double-acting gas and Diesel engines of large capacity. Such features are the joint between the two cylinder sections in a plane through the ports, the water cooled metallic stuffing box and the lower cylinder head with integral water jacket which permits of the desired flexibility because of the large difference in diameter between the inner and outer walls. The upper end of the cylinder is closed off by a cylinder head of the standard box type.

As previously explained, the advantageous method of scavenging used reduces the length of both the cylinder and piston to a minimum, thus reducing inertia forces. The piston is therefore remarkably short, being only 1.3 times the bore, and is capable of being reduced still further in an engine with less bore to stroke ratio, while in most double-acting engines of recent manufacture, this ratio is from 2.25 to 3 times the bore.

Having decided on the size to build, and the general characteristics so far described, various other decisions had to be made in order to conduct a comprehensive line of experiments. The size chosen was 16 in. bore and 22 stroke to run at about 165 to 180 r.p.m. The former for marine, the latter for stationary installations. The engine was designed for three cylinders and the bedplate was made accordingly but only one cylinder was erected to test out at first the soundness of the engine's structure and the scavenging method. Illustrations on page 418, of the May issue of MOTORSHIP, show the assembly of this one cylinder unit on a three-cylinder bedplate, and with a three-throw crankshaft.

(*To be continued in the July issue*)

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A Hundred Million Dollar Industry

Diesel Powered Workboats Assume Place of Importance in Existing Scheme of Transportation Throughout America

FOLLOWING the impetus given American shipping during the late War, a remarkable growth has taken place in the use and application of the Diesel engine to the workboat. Included in this new class of users of the oil engine are tramp tugs, and little coastwise freighters to ferries plying across open links in various highway systems. In addition there are small lake craft, fish boats, canal barges, sound and bay type freight and passenger packets and numerous river craft. Thousands of small operators on both coasts of North America and through the great Southern river system depend on these sturdy craft for a livelihood. Their continued operation depends first and last on a reliable and economical power plant that will give a maximum of efficient service with a minimum of attention and cost for fuel. They are usually operated by one or two men; sometimes only the owner and an all-round handy man for the rest of the crew. The larger fishing vessels and freighters employ crews to perform various additional duties.

According to figures obtainable there are 11,000 motor-vessels under 500 tons in the United States that fall in the commercial class. Twelve hundred of this number operate on Western and Southern Rivers. The major portion of these vessels are either now powered with, or will soon be converted to Diesel-engine drive. Many important refinements developed by builders of the small Diesel engine have placed it in a class far superior to gas or distillate engine; such refinements include more favorable reductions in weight and size. Fuel economy is too well known an item to discuss, five cent fuel-oil compared to twenty cent gasoline is an example. And this is in gallons, not pounds measure which makes additional difference when figuring cost of fuel. Conservative figures show that a well placed Diesel installation in a small craft will pay for itself in from four to seven years in savings on fuel alone, or will pay for the higher cost over a gasoline engine in six months. Taking the total power of these craft at 560,000 b.hp. and a valuation based on a tonnage of 633,129, we obtain a total valuation of over 93 million dollars, when figuring the hull cost at $100 a ton and the power at $60 per horsepower.

The status of the workboat is rapidly approaching the class of a hundred million dollar industry. With the tremendous expansion of the North American highway system, hundreds of stretches of open water have developed the need of some form of bridge. Small economically operated ferries, run by a crew of three, on a very small margin of profit, now operate pending the time of bridge construction which in many cases is either impossible or will be delayed for a number of years. Many of them are scattered over sparsely populated sections, connecting up islands with mainland where expensive steam or gas powered ferries could not operate profitably. Lighters and tug boat operators on short harbor runs are finding the ease of control, simplicity of operation, small crew and no standby loss of the Diesel engine the best power obtainable. Small freight and passenger packets operating on sounds and lakes have discovered that profits may be increased with cheap oil engine power.

The last two groups to give way to the

In the waters around Manhattan exists one of the largest potential markets for marine Diesel engines. Almost every type of boat is to be found in service from the smallest to the largest. There already are over two hundred oil-engined craft operating, but the surface has only just been scratched

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economies of the Diesel, are the canal barges and the river craft. Geared and electric stern wheel drives are displacing the noisy "choo-choo" of the old river craft of the days of Mark Twain. The endless procession of barges laden with grain and coal, that run down the canal from Buffalo to New York during the summer months are installing Diesel drive to replace the steam tug. This important evolution of the picturesque canal barge from the tow path days to self-propelled ships is regarded by shipping men as one of the most forward steps ever taken. It is now possible to dispense with the tug, hence a lower investment and operating cost and an actual saving of space in the locks, a vital factor in this traffic. When the barge operator prefers the tug system, Diesel tugs are far more efficient and economical than steam craft.

With these factors in mind we have felt the need for some time of a special section in MOTORSHIP wherein the problems of the Diesel workboat operator could be discussed in detail. Economy and dependability of his power equipment will govern to a large extent the success or failure of his boat, and it is our intention to be of assistance in the solution of such problems. Beginning with this issue we are devoting a special section to this rapidly expanding field of motorshipping. We welcome constructive suggestions from the field, and we will endeavor to limit our coverage in this department to boats propelled with Diesel engines up to about 350 horsepower.

The day of the workboat is here. It has come to occupy a definite place in the American economic scheme. With her great inland waterways and extensive seacoasts, America offers the greatest market in the world for the small workboat and it is growing at a tremendous rate. It is estimated that there is close to five million dollars' worth of workboat construction under way at the present time, the bulk of it being Diesel powered. The tonnage once sacrificed to the railroads and auto is being replaced with a readjusted water transportation structure that recognizes that economy is of more importance than speed. Only the economically operated motorship can rebalance the high rail and truck rate structure, and the American business man, particularly the non-committal banker is waking up to this fact. With the attention of Congress being turned to the opening up of many branches of the Mississippi and St. Lawrence waterway system, the workboat looms larger in the picture than ever before.

In presenting the first segregated workboat section of this journal, we are dealing largely with the Atlantic and Pacific Coast fishing fleets, the largest market at the present time for small Diesel conversions, and already largely powered with oil engines. Out on the Pacific Coast the largest fishing fleets in the world are being Dieselized, and our British Columbia correspondent tells what is being done in the North Pacific. The fishing fleets at one time were mostly gasoline propelled, but with California fuel selling at 4 cents a gallon, the thrifty fishermen who cruise thousands of miles into Alaskan and Mexican waters after salmon and tuna are turning to Diesel power.

Operating Hints for Workboat Engineers

Clean Water Jackets Essential to Reliability

BY means of water circulation alone some 30 per cent of the fuel consumed in an oil engine is dissipated. A dual exchange of heat occurs, first from the products of combustion to the surrounding metal and then from the metal to the water. If for any reason this exchange of heat be interrupted the metal will heat excessively for the obstruction would have to occur between the metal and water, not between the gases and metal. Even under existing conditions of temperature, lubrication of cylinders is something of a problem.

Mud picked up in shoal harbors and rivers is the commonest source of scale and but little can be done to prevent it. Rapid circulation helps, because it keeps the water stirred up and moving. In all cases of stopping the engine with muddy water in the jackets, however, precipitation occurs and deposits form on the cylinder head crown and around the valves where heat is most intense, and effective cooling most needed.

These spaces should be cleaned as often as deposits form. If in the course of operation it is found that such deposits reoccur, time after time, at short intervals, the condition may be improved, as far as danger to the cylinder heads is concerned, by piping an independent jet of water to the place where accumulations are greatest. This sets up a local turbulence, by means of which the deposits may be reduced.

Salt scale formation is very unusual and when it occurs it will only be local, where some abnormal condition of sluggish circulation, the presence of steam or air pockets or an obstructed water passage has allowed an abnormal temperature to rise in the metal, which would tend to cause fractures as well.

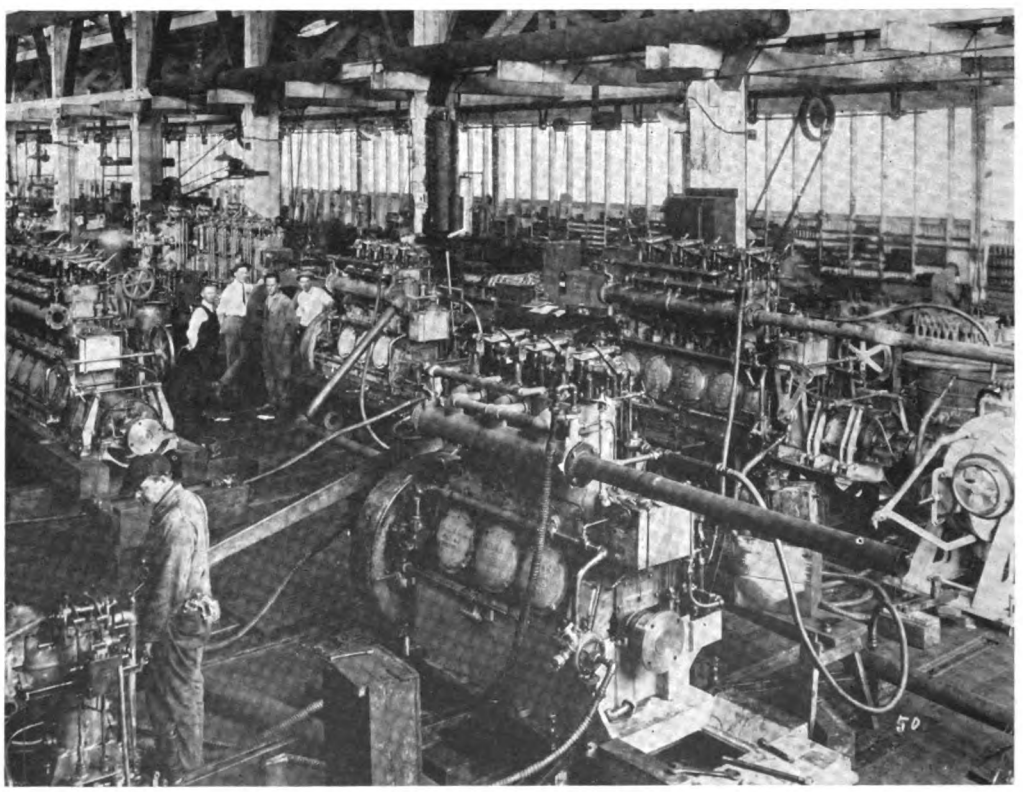
The use of hydrochloric acid or very strong caustics in the removal of scale is to be severely discouraged, except in cases where scaling tools cannot be used.

It sometimes happens that oils and grease find their way to the cylinder cooling space as the result of using the circulating pump to pump bilges. In this case caustics are about the only remedy. The solution should be made strong and left in the jackets until every vestige of grease is dissolved.

In addition to that, the piping system should be changed so that no bilge water can reach the cylinder jackets. If this cannot be done for want of pumps, more pumps should be purchased and installed. Just as surely as this condition is allowed to continue will fractured cylinder heads, warped and badly worn cylinder liners occur, for grease impregnated scale is one of the most excellent heat non-conductors.

At Ballard, Washington, two large craft for the Alaska fisheries are nearing completion. One is a 68-ft. herring schooner, with a 90-hp. Washington-Estep Diesel, for the Chambers Company, of Seldovia, Alaska. The other is a 69 ft. halibut boat; 100 hp. Washington-Estep Diesel for Seleride Bros., at Yakatak, Alaska.

Altogether three 120 ft. Diesel-driven trawlers are under construction at the Quincy yard of the Bethlehem Shipbuilding Company. Two are for the Mass. Trawling Company, Boston, and the third is for the R. O'Brien Company of Boston. Each boat has a 380 s.hp. Bethlehem Diesel engine.



Interior of the school equipped and maintained by the Atlas Imperial Engine Co. at Oakland, Cal., for instruction of steam and gasoline engineers in the operation and care of the small four-cycle Diesel engine

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A view of Sheepshead Bay, Long Island, N. Y., where a famous fleet of party fishing boats operate ten months out of the year. Seventeen of this fleet are powered with Diesel engines, and everyone a booster

Diesel Power Near Gateway to Manhattan

Party Fishing Boats of Sheepshead Bay Turn to This Economical Form of Propulsion

WHEN Captain Harry T. Rigby, veteran skipper of Sheepshead Bay party-fishing and passenger boats installed an oil engine in his passenger boat UNCLE SAM, back in 1921, he started a big ball rolling. Seven years ago most of the large fleet of fish boats operating out of New York City's sport fishermen's harbor were gasoline or steam propelled and the Diesel engine was an unknown proposition in the minds of many of the owners. Being of a cautious and skeptical nature, they preferred to stand by the older forms of power, and let somebody else bother with scavenging pressures, injection nozzles, four-cycle and two-cycle problems, and all the rest of the problems of Diesel engine power.

With a keen eye to the future of the fuel prices, and the economies of using cheap fuel-oil, Captain Rigby pioneered the Diesel engine in Sheepshead bay with a 60 hp. Fairbanks Morse engine in the UNCLE SAM, followed closely by the second installation of 60 hp. engine of the same make in the NEPONSET. Close check on the fuel consumption of these two installations forced Captain Rigby to conclude that Diesel drive would be the best for his then new boat the BROOKLYN. The BROOKLYN was the first party boat on Sheepshead Bay to be powered with an oil engine and installation was completed in the Spring of 1923.

Since the BROOKLYN was completed, approximately one third of the owners of boats of the same class have installed Diesel drive. Today there are 17 of the fleet of 40 odd pleasure fishing craft enjoying the economies of operation and maintenance of the oil engine.

The fishing fleet activities on Sheepshead Bay began about forty years ago with a few small boats, and because of its proximity to the densest populated section in the country, has grown to be a mecca for lovers of deep sea and coast fishing. With the increasing popularity of fishing trips, the skippers of the fleet have grown up with the business and are now strongly entrenched as any fleet of commercial ships or world wide shipping corporation. They have a well organized association, namely, the Sheepshead Bay Boat Owners Association which regularly publishes a list of scheduled sailings.

There are two distinct groups of pleasure fishing boats down in Sheepshead Bay,

The Comanche, Capt. J. Moravec, Atlas-Imperial powered

a mosquito fleet of three or four hundred motorboats and a fleet of the larger ocean-going boats. Practically every kind of power is represented in this group of ships, from big coal-burning steam ex-yachts down to little 40 hp. Diesel craft that venture out on good days with a small selected party of the followers of Izaak Walton. Since the BROOKLYN was Dieselized many careful tests were made by the anxious captains of other power craft, who realized that they were throwing money away on their expensive power. Gradually, one by

The Giralda, Bessemer powered, and the largest motorboat on Sheepshead Bay

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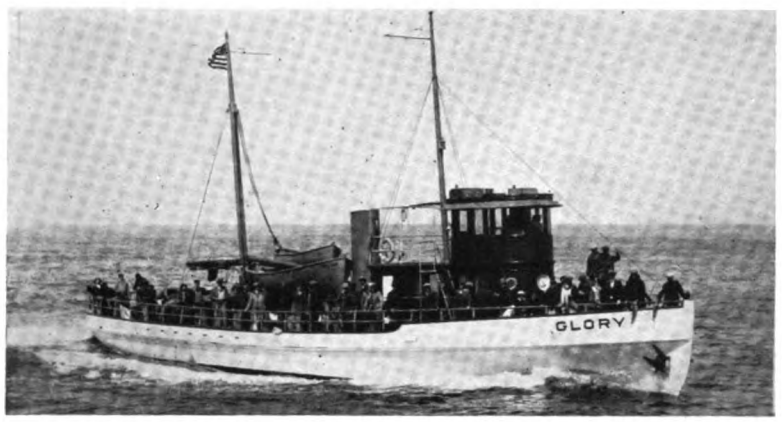
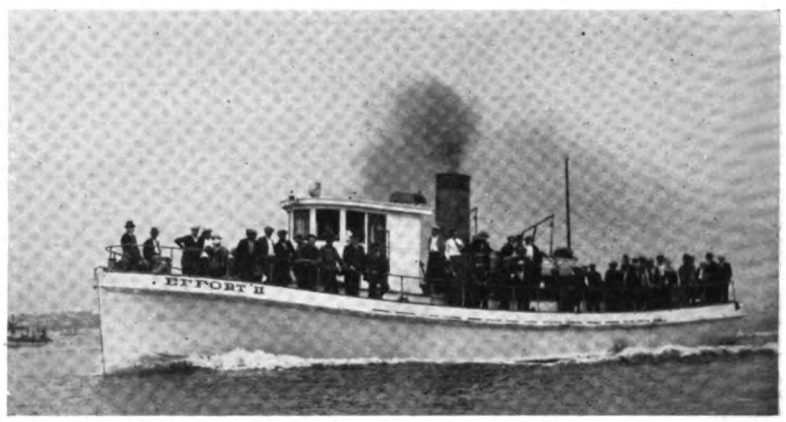


The Glory, Captain Martin, she is the second largest Sheepshead boat



The Effort II has a 120 hp. Fairbanks-Morse engine

one, their steam and gasoline plants have been displaced with Diesels.

From the very first day the first oil-engined "ship" sailed out of the harbor, there has been a continuous and friendly argument as to which type, the two or the four-cycle engine was best. Captain Rigby swears up and down by his two-cycle Fairbanks Morse engine and stoutly maintains that nobody on earth can beat him on fuel consumption, while Captain Joe Moravec will swear even louder over the merits of his Atlas-Imperial four-cycle engine. Likewise Captain Weber, skipper of the M.J.R. stoutly maintains that his four-cycle six-cylinder Standard engine can run circles around anything in the bay, while Captain Schwartzbach with his trim new ship the FISHER, knows positively and absolutely that his 180 hp. six-cylinder pump-scavenging Bethlehem powered boat is the best and fastest that ever sailed down the bay to the Atlantic, and offers to prove it.

The argument goes merrily on, with no solution in sight, for experience of these men show that there is not much difference in either direction, especially in this class of ship, as various types of power give different results in different ships.

The big, outstanding factor in the idea of Diesel drive for these boats is economy of operation. Another minor, yet no less important factor is absence of vibration. The smooth, steady power stroke of the Diesel has made it a favorite among the Sheepshead skippers. As Captain Schwartzbach and his engineer brother, George have aptly stated it: "S'no use taking a bunch of fussy business men out fishing if the ship wiggles and vibrates enough to shake out their false teeth or have them lose their glasses; it actually happened several times with us when we had an old gas engine; the back deck shook so that one man lost his upper plate." These minor but very personal items certainly do help the Diesel enthusiasts win their case.

The largest installation on the bay is the GIRALDA, with 420 s.hp. She is a sea-going 130-footer with a 16-foot beam, and is powered with a six-cylinder four-cycle Bessemer engine. She was formerly a coal-burning steam yacht and since her conversion to Diesel drive, fuel costs have been cut to a little over a dollar an hour and only one engineer. The saving meant the elimination of one fireman and the outlay of about $4.00 per hour for fuel. She has a speed of 15 knots and goes as far up as Barnegat Bay. The GLORY, also owned by Captains D. and J. Martin, which we reproduce herewith, is driven by a 6 cylinder 320 hp. Bessemer engine and shows a similar remarkable economy.

Another interesting vessel is the COMANCHE, powered with a four-cylinder Atlas-Imperial engine developing 75 s.hp. She is 54 feet long, and has a breadth and draft of 54 feet and 5 feet respectively, and has room for 50 passengers. Her power gives a speed of about 11 miles on three gallons of fuel per hour. Compared with four gallons of gasoline formerly necessary with the gas engine, her fuel costs have been cut one-fifth. Captain Moravec declares that five gallons of lubricating oil per month will be ample with his new power.

Capt. Harry T. Rigby's Brooklyn was the first Diesel boat on Sheepshead Bay

The Fisher, Capt. Schwartzbach, has a 180 hp. Bethlehem two-cycle engine

Captain Ecock's Elmar with a 75 hp. Atlas-Imperial

The ELMER, Captain Joe Ecock, is another interesting conversion powered with an Atlas-Imperial engine. She uses approximately four gallons of fuel per hour and a half-pint of lubricating oil. Her engine is an 80 hp. four-cylinder unit which gives her a speed of 12 miles per hour. She has an overall length of 81 feet and carries 83 passengers.

In the two-cycle group are three interesting fast ships, the EFFORT, EFFORT II and the EFFORT III, each powered with four-cylinder Fairbanks Morse engines. EFFORT has a 100 hp. engine; the EFFORT II and the EFFORT III each 120 hp. They are fast, dry ships and though named after the same family, are owned by Captains Rickert, L. Harms and F. Wredge. Much quick-witted rivalry is necessary to keep passengers bound for one ship from being spirited away to her like-named sister ship. The three-cornered race for trade is one

(*Continued on page* 526)

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A typical B. C. deep-water purse-seiner with net ready to haul in

There are 2000 of these craft engaged in the North Pacific fisheries

Diesels Break Into B. C. Fishing Trade

Recent Survey Shows That Fishermen Are Now Showing Preference for Diesel Engines of All Types to Power Their Ships

UP to within the last 4 or 5 years the fishermen of the British Columbia coast seemed wedded to the 4 cycle gasoline engine and regarded any innovations with suspicion. Among the halibut fleets especially their very lives often depended on the perfect functioning of the engine, no matter what the conditions; for the fishing banks in the open Pacific off the coasts of British Columbia and Alaska are subject to gales of great severity. Halibut fishing also required an engine that could be run at slow speed for long periods, while good power was required to get the catch to market, as soon as possible.

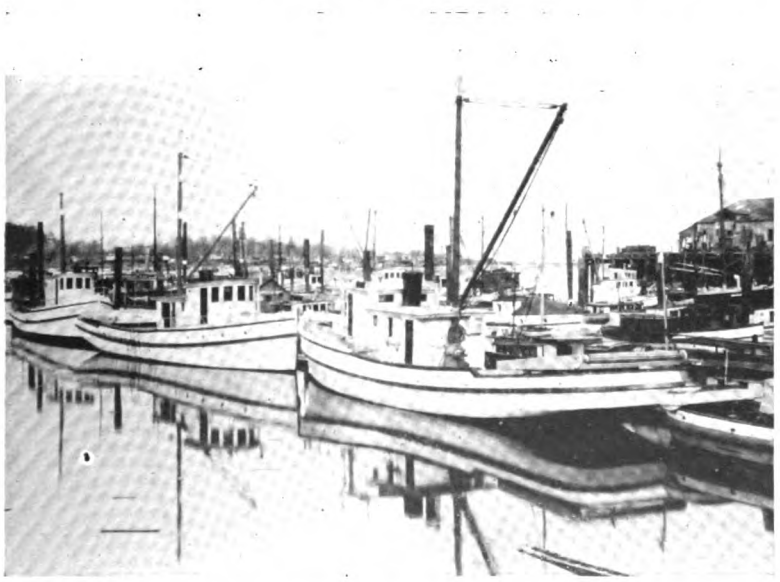
Previous to 1923 a few surface ignition oil engines of Fairbanks Morse type had been introduced in cannery tenders and fish carriers, and in that year the Anglo-British Columbia Packing Co. installed the first small Diesel engine, a 55 h.p. 3-cylinder Atlas-Imperial of 4 cycle airless injection type in their cannery tender LAUREL LEAF.

From fish carriers the use of Diesel and surface ignition oil engines spread rapidly in the next few years among the fishermen themselves, being installed both in cannery owned boats and private craft. The fishing population of this coast has been drawn from almost every quarter of the globe except perhaps the sections occupied by the black races. The largest proportion are white, but the Indian tribes of the coast are born fishermen, and there is also a large Japanese representation. Now, irrespective of race or color, they are becoming interested in oil engines, of which many suitable types are available.

During the last two years the construction of seine boats for the salmon and herring fisheries has been unusually heavy; and most of these boats are adaptable to halibut fishing also. They range in size from about 40 to 65 ft. in length, with generous beam and lots of carrying capacity. Most of these boats in the largest sizes have been equipped with Diesel engines; and while in sizes under 50 ft. the gasoline engine still has predominated there has been still a large percentage of oil engined craft among these boats.

The various makes of 4-cycle airless injection Diesel engines manufactured on the Pacific coast of America are largely favored for boats in the fishing industry, with the 2-cycle Diesels also gaining a foothold; while British oil engines and various makes of both Diesel and semi-Diesel engines from the Scandanavian countries are found in considerable numbers.

Among craft engaged in the fishing industry on the B. C. coast there are at least seven different makes of 4-cycle airless injection Diesel engines being used; and as many different designs of surface ignition oil engines. The 2-cycle airless-injection Diesel engine of Fairbanks-Morse make, just recently introduced, has a number of attractive features for the fisherman; while the new Petter medium compression oil engine comes on the border line between the cold starting 2-cycle Diesels and the



A fleet at anchor in Vancouver harbor

These boats are among the heaviest built

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A Vancouver herring seiner

In the fitting-out dock

surface ignition engines, having electric plugs to warm the combustion chamber when starting from cold.

Most of the boats used for seining are of comparatively light construction, having steam bent oak frames, and being mainly planked with fir, with the keel and most of the other timbers fir also. Gumwood, however, is frequently used for stems and sternposts. In boats of 60 feet over all by about 15 feet beam, which is a common size, the oak frames run in the neighborhood of 2½ by 3 in., spaced 10 in. between centers, while the planking is about 2 in. thick. Good foundations for the oil engines are obtained by using exceptionally heavy engine bearers extended as nearly as possible the full length of the boat. In a boat of this size a Diesel engine of 60 to 75 h.p. is commonly installed, giving her a speed between 8 and 9 knots. There is usually a power take off from the main engine to run the seine winch.

About 70 seine boats of various sizes were built in the neighborhood of Vancouver, B. C., during the last year, and nearly as many the year before. A good example of these boats was Crozier & Williams' EXILDA 60 ft. overall by 15 ft. beam with a 75 hp. 3-cylinder Washington-Estep Diesel having 8¾ in. cylinder bore and 12½ in. stroke and developing its full power at 350 r.p.m. This engine turns a 3-blade propeller of 45½ in. diameter and 38 in. pitch; while the weight of the engine including auxiliaries air tanks, propeller and shafting is 19,000 lb. H. Kameda's PORT ESSINGTON is a similar boat 57 ft. 4 in. in length overall, 16 ft. 3 in. beam and 8 ft. 9 in. molded depth. She also is equipped with a 75 hp. Washington-Estep Diesel.

The two seine boats for the Gosse Packing Co. shown in the photograph are standard types of British Columbia seining craft 63 ft. overall by 15 ft. beam, built by Menchions at Vancouver and equipped with 65 hp. Atlas Imperial Diesel engines. The seine table with its wide roller for taking up the seine net is seen on the stern.

The two boats completing their engine installations alongside a slip at Vancouver, B. C., are Chris. Wagg & Ole Johnson's ANTLER 58 ft. o.a. by 14 ft. 3 in. beam with a 3-cylinder 65 hp. Enterprise 4-cycle Diesel engine; and A. Pederson's CAPE BLANCO 63 ft. o.a. by 15 ft. 4 in. beam in which a 3-cylinder 75 hp. Atlas-Imperial Diesel engine is installed. These boats can be used for seining salmon, herring or pilchards, and also for outside work on the halibut banks; while their large carrying capacity makes them useful craft for fish packing between the seining fleets and the canneries.

The adaptability of certain designs of low compression 2-cycle oil engines to this work is indicated by the number of surface ignition engines now at work in fishing craft, and other new installations being made this year. Jas. Fiddler's halibut fishing boat JOAN W., measuring 55 ft. overall, 13½ ft. beam and 5½ ft. draft is equipped with a 48 hp. Gardner oil engine; while Geo. Bagley's BOSTONIAN 7, another Vancouver boat measuring 46 ft. o.a. by 13 ft. 3 in. beam and 6 ft. draft is equipped with a 36 hp. 2-cylinder Gardner oil engine turning a 3-blade propeller of 36 in. diameter and 27 in. pitch at 400 r.p.m., which gives her a speed of 7¼ knots. This class of boat when halibut fishing does not use dories, but long lines with a baited hook every few feet are set from the fishing vessel.

While the halibut fisherman uses baited lines, the seiner has a mesh net with a line of floats on the top edge and lead weights on the bottom. Having located a shoal of fish the seiner circles around them dropping the net, which is then hauled in on board the seine boat. The last portion of the net to be taken on board forms a purse in which the fish are held. At times tons of fish are taken on a single set of the seine, especially when seining herring or pilchard while over 12,000 salmon have been reported taken in one haul.

(*Continued from page* 524)

of the chief topics of speculation among the Sheepshead Bay skippers.

Continuous performance, low maintenance costs and greatly reduced fuel costs are winning and holding this prosperous bunch of workboat operators. Most of them figure the life of their engines in this service at 20 years, and before many years pass, the last of the gasoline and steam boats will be converted to Diesel drive. The Association boasts of not a single accident to any of its boats during the past 25 years, and each year the number of passengers is steadily increasing, and with economical operation will continue to be a highly profitable field for the workboat owners. They operate ten months out of the year and many do towboat duty in New York harbor during March and April.

There are also six small ferry boats plying between Sheepshead Bay and Long Beach, each between 60 and 64 feet long and all powered with three and four-cylinder 75-110 hp. Bessemer Diesel engines.

In an early issue we plan to cover the Jamaica Bay fleet.

Following is a list of the Sheepshead Bay boats that have Diesel engines installed:

Boat	Captain	Make	H.P.
Giralda	D. Martin	Bessemer	420
Glory III	J. Martin	Bessemer	360
Effort III	F. Wredge	Fairbanks Morse	120
Effort II	F. Wredge	Fairbanks Morse	120
Effort	Rickert	Fairbanks Morse	100
Brooklyn	H. Rigby	Fairbanks Morse	60
Whitby	F. Hammer	Fairbanks Morse	60
Nancy B		Fairbanks Morse	60
Cap. Joe II	Archie Buckner	Fairbanks Morse	60
Shamrock	Fred Plage	Fairbanks Morse	150
Fisher	Schwartzbach	Bethlehem	180
R. C. Lundy	Lundy	Atlas Imperial	90
Comanche	Joe Moravec	Atlas Imperial	75
Yankee Doodle	Bill Allen	Hill	40
Elmar II	Gus Rau	Fairbanks Morse	100
Elmar	J. Ecock	Atlas Imperial	75
M. J. R.	Weber	Standard	90

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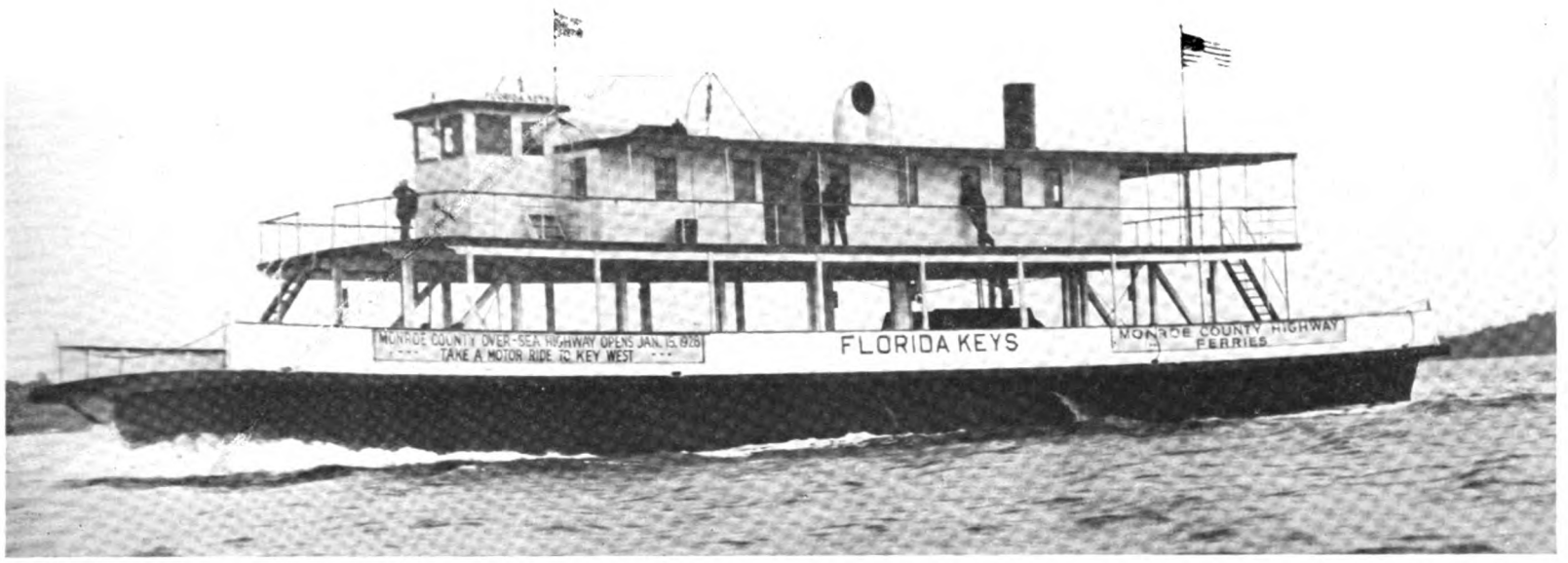

MONROE COUNTY OVER-SEA HIGHWAY OPENS JAN. 15, 1928
TAKE A MOTOR RIDE TO KEY WEST
FLORIDA KEYS
MONROE COUNTY HIGHWAY FERRIES

Three of these 200 *hp. ferries, the Monroe County, Key West and the Florida Key are bridging an open stretch on the Miami-Key West highway. They are powered with twin* 100 *hp. Fairbanks-Morse engines*

Three Diesel Ferries for Florida Key Service

The increasing use of the small Diesel engine for propelling ferries for service on short runs, shallow water and temporary crossings while bridges are being completed is reflected in the three new ferries recently put on a run on the Florida-Key West highway. The three ships, the MONROE COUNTY, the FLORIDA KEYS and the KEY WEST, are of the shallow draft type, and have an overall length of 110 feet and a beam of 24 ft. and a loaded draft of 4 ft. They are driven by a twin installation of four-cylinder Fairbanks Morse Diesel engines developing 100 horsepower each. Each engine has a bore and stroke of 8½ and 10½ inches respectively and develops its rated power at 420 R.P.M. An 850 watt Delco lighting system is also installed. The engines swing a 40 x 36 Columbian propeller, which gives each boat a maximum speed of 11 knots. The boats are equipped with twin rudders to decrease the draft and increase the steering efficiency.

The main automobile deck of each boat carries three runways. This is made possible by the fact that all power is below the level of the main deck, access to the engine-room being through three hatches which close down flush with the middle driveway. The upper deck carries a large glassed-in passenger saloon entirely surrounded with an outside promenade, with space on the aft deck for outside observation. Forward from the observation deck there is a large dining saloon with a large galley. There is also a large lunch counter in the main cabin.

Boats of this type are economical to operate and provide a maximum of comfort for passengers. If expensive steam installations had to be depend on it is doubtful if service could be maintained over such a route.

Old Wooden Canal Barge To Be Diesel Powered

When work is finished on the conversion of the sturdy old wooden canal barge, known as plain "1120," from a silent gray hulk to a snappy looking motor barge, another minor, but no less interesting chapter in motorshipping history will be written down.

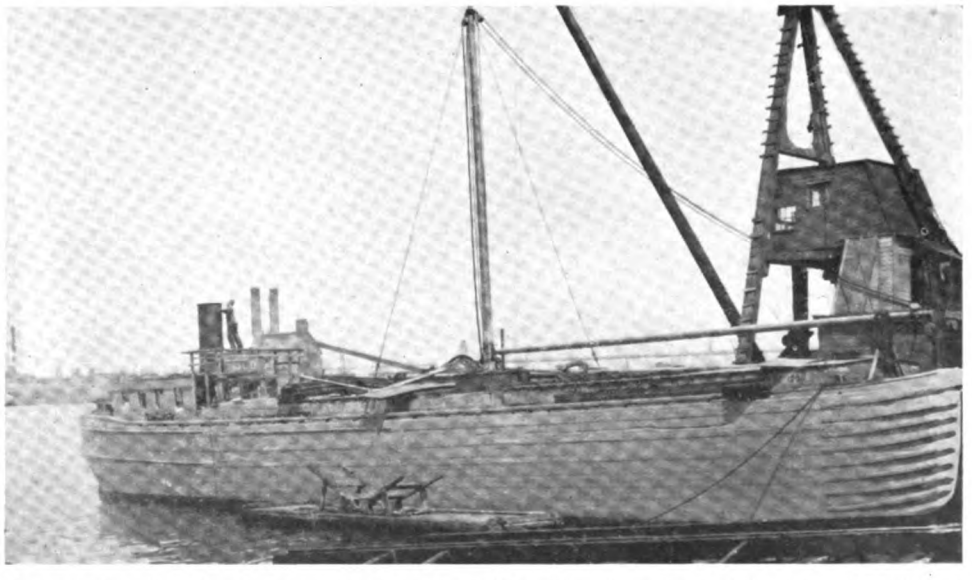
For the past forty years the barge has been plowing back and forth between Buffalo and Albany and New York with her cargos of coal, grain and other bulk freight in tow of a mule or tug. She is built out of heavy oak and pine timbers and is far more durable than good looking. She had the customary square stern and blunt "apple" bow, like all other vessels of her class. Her owners decided recently that the hull was good for many years yet, and she was heavy enough to stand the weight of a Diesel engine as well as her cargo.

Conversion work is being done at the A. C. Brown yards at Tottenville, Staten Island, New York. It consists of putting a narrow bow and a rounded stern on her and rebracing aft to stand the heavy weight. A neat cabin and pilot house with a stack mounted on top has been built at the stern, and is directly over the engine room. The barge will be powered with a 180 horsepower Fairbanks Morse two-cycle Diesel engine driving a three-bladed propeller. The barge has a overall length of 107 feet, 17.6 ft. beam and 11 foot draft when loaded, and is owned by Stewart J. Dailey.

This conversion job is another step forward in the Dieselization of America's fleets of small boats. It marks a turning point in the handling of freight down the great inland waterways of the East and Middle West and is the forerunner of an expansive development in this field, since the compact, self-propelled canal barge is far more economical to operate than the tow boat and individual barges, and may navigate locks much easier.

F. L. Fulton, of Antioch, California, has completed a 65-ft. freighter with a 120 hp. Atlas-Imperial Diesel, for service between San Francisco and points on the Sacramento and San Joaquin rivers.

Anderson and Cristofani, of San Francisco, are building a 72-ft. purse-seiner for K. Hovden, of Monterey, to be given guaranteed speed of 10 knots by a 135 hp. Diesel engine, of make not yet announced.



Age or size doesn't stop owners from installing Diesel engines. The famous old New York State Canal barge No. 1120, *a* 40 *year old wood craft now being converted at the Brown Yard, S. I., New York. She will carry a* 180 *hp. F.-M. engine*

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Reducing Cost of Stern Bearing Maintenance

WHEN we take into account the severe service to which outboard bearing material is exposed, we do not find it surprising that for many years wear proved to be a baffling problem. It is almost impossible to apply any form of lubricant to such bearings, save the water in which they run. A natural rubbing action of the shaft in the bearing tends to eliminate oils or grease which have no natural affinity for water, and at best are difficult to apply. Methods of their application have been devised. Each one of these failed for one reason or another, not the least important of which was the quantity of lubricants required to compensate for natural dissipation. This resulted from an unavoidable flow of water through the bearings.

A few years ago the nearest solution of this problem appeared to be lignum vitae, which possesses certain natural lubricating qualities in the presence of clean water. It reduced the wear to the lowest amount obtainable at that time. Due, however, to peculiar characteristics of the wood it had to be long enough to give a sufficient bearing surface to support the shaft. Its texture was not sufficiently resilient to prevent the lodgment of abrasive substances which cause rapid cutting whenever entrained in the water and carried into the bearing.

Realizing the potential demand for a less troublesome bearing substance under all adverse conditions of operation, and so provide an average life much longer than any other substance then in use, the Goodrich Rubber Co. produced the Cutless rubber bearing which is said to be superior to all others. Just how successful it has been is a matter of less common knowledge than seems justified, since its use involves a substantial saving as evidenced by the statement of Roy A. Brinkman, Superintendent, Construction Materials Co., Chicago—

"We are very much pleased with the service we have been getting from the two Cutless bearings which have been installed on our motorship SANDMASTER. They have been in service for one year and show only 1/64" wear. These bearings are 34½" long by 13" outside diameter and fitted for a 10" shaft.

"The shells of these bearings are made of cast iron and split; from present indications it seems that they will last another year or two.

"The lignum vitae bearings formerly used lasted from three to four months. For use on a vessel like the motorship SANDMASTER where bearings are in the strut, I believe cast steel shells would be preferable to cast iron."

Due to the character of the work, sand dredging, in which the SANDMASTER is engaged it seems surprising that a strut bearing would last a year no matter what the form of bearing material may be. However, two years of service is expected and, by basing our estimate upon the permissible clearance in lignum vitae bearings, we venture to predict more than two years of service if the rate of wear does not increase.

Construction and Conversion Notes

Several important additions to the fleet of small workboats plying along the Mississippi and southern rivers are under construction at the yards of Charles Ward Engineering works at Charleston, W. Va. Three Diesel-driven river towboats of the geared-drive, stern wheel type are under construction for river ship operators. Each boat will have overall dimensions of 64 ft. x 18 ft. x 4 ft. A 360 hp. Diesel towboat of 85 feet length is also being built. The boat is powered with two 180 hp. engines, and will be operated by the Alpha Sand Company of St. Louis.

Several 65-foot boats to be fitted with 120 hp. Diesels are now being designed by the U. S. War Department for service in the Philippines.

The New England Fish Company has ordered its third Diesel-driven cannery tender from the Lake Washington Shipyard, at Houghton, Wash. The new craft is to be equipped for both towing and carrying. She is to be 72 ft. long, 17.5 ft. beam and 8 ft. deep, with a three-cylinder, 110-hp., Washington-Estep Diesel engine, driving her at 10 knots, the same speed made by her sister ships, A. F. RICH and O. M. ARNOLD, built for the same corporation by the same yard last year. An especially large engine room, 17 ft. long by the full width of the boat, marks all three of these tenders, which are to be used in rough water outside. There is a Delco auxiliary lighting outfit, and 2,000 gallon fuel tanks, with 1200 gallon fresh water tank in the stern.

For the first time, construction of motor workboats, especially fishing craft, has taken the lead over that of pleasure boats in the yards at San Pedro and Wilmington, in southern California. For the four months of 1928 ending May 1, workboat construction was more than $1,000,000 while pleasure-craft building totalled only $945,400. Of the workboats built, more than half carry Diesel engines, and about 80 per cent of the total construction is for the fishing fleets. Their cruising radius will be 4,000 to 5,000 miles and they are to be used in fisheries off the Lower California coast of Mexico.

The husky little workboat PANSY, Captain Percy Black owner and skipper, recently was converted from a gas-engined ship to a Diesel boat at yards in Bayonne, N. J., her home port. Her former power plant was replaced by a 40-60 hp. Atlas-Imperial four-cycle Diesel engine. The engine has four cylinders, having a bore and stroke of 6½x8½ inches, and delivers the rated horsepower at 475 R.P.M.

The PANSY has an overall length of 51 feet, a breadth of 16 and a draft of five feet, and was built at Astoria, L. I., New York, in 1909. She has been in service for 19 years as a tow boat, fish boat and a party boat.

She ran her trial trip under the new power on May 21, from New York, and outside of a plugged fuel line, made unusually good speed up the Hudson. On the down trip she averaged about 11 knots and uses approximately 2.4 gallons of fuel per hour with an oil consumption of approximately 6 ounces per hour. She will carry 58 passengers when used as a party boat and her owner plans on taking her down the Atlantic Coast to Florida this Fall for Tarpon fishing.

Nunese Brothers, of Sausalito, California, are completing two 115 ft. deep-sea boats, for tuna and albacore fishing, off San Pedro. They will be equipped with Diesel engines, but makes and powers have not been announced. It is understood that, when completed, they will be the most expensive tuna-fishing boats yet built.

Pump for Workboats

A new marine pump has just been announced by the Martell Packings Company of Elyria, Ohio. It can be used for all densities of oils and fuels as well as air or gas and for vacuum. It is of the rotor and sliding blade type, and the pump is designed to operate on pressures up to 100 lbs. or to hold a vacuum of 25 inches. It is especially designed for oil or cargo pumping duties and is distributed in New York by John A. Heuse, 51 E. 42nd St.

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